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S-3A BALLAST BLOCK FINAL DESIGN AND ENGINEERING TESTS

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The S-3A Ballast Block is a 169 pound (77 Kg) assembly of four (4) interlocking aluminum blocks. It is used to control the trajectory of an unoccupied 1E-1 ejection seat.

Tests indicate that it meets all functional and structural requirements for use in the S-3A aircraft.

It provides a simple cost effective replacement for anthropomorphic dummies presently being used as ballast.

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SUMMARY

The third prototype S-3A Ballast Block weighs 169 pounds (77 Kg). It is an assembly of four interlocking aluminum blocks. One crewman can carry two blocks at a time into the aircraft where he can quickly assemble the unit either on the 1E-1 ejection seat or on the avionics aisleway step. Restraint on the ejection seat is obtained by connecting the four quick disconnect adjuster fittings on the ejection seat to fittings on the Ballast Block. When the Assembly is placed on the avionics aisle steps it is restrained with two aluminum locking plates which are bolted to the top block. These plates extend beyond the edges of the block and fit into keyways on either side of the main bulkhead forgings directly behind the aft ejection seats.

When the Block is secured on the 1E1-1 seat the overall center of gravity falls 0.72 inches below the centerline of rocket thrust. The Ballast Block meets all operational and structural requirements for safe function in the aircraft. It can be maintained at the Operational level; the only parts that may need replacement are straps which are readily available.

The S-3A Ballast Block provides a simple and cost effective replacement for anthropomorphic dummies presently being used to ballast unoccupied 1E1 ejection seats.

INTRODUCTION

BACKGROUND

The S-3A aircraft has (4) ejection seats. Both the pilot and copilot have Command Eject Selector levers which allow them the option to eject all crewmembers or "Self Eject." If one of the aft seats is unoccupied, and "Command Eject" is selected, the unoccupied seat will accelerate ahead of the occupied seat next to it. Two hazards exist; first, the crewmember next to the unoccupied seat could be burned by the rocket plume from the empty seat which has a higher acceleration; second, the empty seat could tumble into one of the other seats because the center of gravity and the center of rocket thrust are too far apart. To eliminate these hazards it is necessary to ballast the unoccupied seat. This is presently being done with anthropomorphic test dummies, if they can be obtained. Unfortunately these dummies have various weights and are usually damaged (i.e. arms, legs, or head missing). There is no guarantee that the center of gravity is in the proper location to prevent tumbling. To correct this potentially dangerous situation the Naval Air Systems Command tasked the Naval Air Development Center to design a ballast block. After the initial prototype was developed and tested, references (1) and (2) recommended changes to be incorporated into the final design. All of these recommendations have been incorporated into the final design.

DESCRIPTION OF FINAL DESIGN

The S-3A Ballast Block is an assembly of four (4) interlocking aluminum blocks that can be strapped into an ESCAPAC 1E-1 seat and can also be securely stored in the aisle on the avionics bay step of the S-3A aircraft (figures 1 & 2).

Two blocks at a time can be carried by one man (figure 3). Each block weighs about 42 pounds (19 Kg).

Straps on the top and bottom blocks have quick disconnect fittings that mate with the parachute/inertia reel straps and with the survival kit straps to mount the assembly on the 1E1 ejection seat (figure 11).

Each block has a handle and a finger ledge on two sides that enable the crewmember to assemble the blocks on the seat without danger of pinching fingers (figure 4).

The center of gravity of the block/seat assembly falls less than one inch (three centimeters) below the center of the rocket thrustline (figure 29).

Aluminum is used to make the assembly antimagnetic so as not to interfere with submarine detection systems.

Each block is stenciled with its number to simplify assembly (figure 1).

Two locking plates are bolted to the top block. They are used to lock the assembly in the aisle position for catapult, arrestment, and flight loads (figure 19).

DISCUSSION AND TEST RESULTS

After the second prototype S-3A Block Assembly (reference 1) was tested at the Naval Air Test Center several problems were uncovered (reference 2);

a. The method for stowing the assembly in the aircraft aisle was not adequate.

b. Steel blocks could possibly interfere with the aircraft Magnetic Anomaly Detector (MAD) system.

A third prototype Block was designed and fabricated using aluminum. It also was taken to the Naval Air Test Center for fit and function tests. In addition, static loads were placed on the assembly to determine if the seat restraint straps and the aisle restraint plates were adequate for 10 G crash, catapult, arrestment, and flight loads.

The final configuration of the Ballast Block is shown on the drawings (figures 21 through 28). It differs from the tested assembly as follows;

a. The final design does not incorporate a rear finger ledge on each block because the crewmen did not use it during evaluation: this ledge was machined into the test blocks.

b. The final – 1 block is 14.12 inches long in order to completely span the Avionics Bay step; the test – 1 block was 13.0 inches long.

These changes will improve the performance of the assembly by increasing its weight, and shifting the center of gravity a bit closer to the rocket thrustline.

CENTER OF GRAVITY TEST (figure 4)

Through a series of ESCAPAC seat suspension tests and mathematical calculations the eccentricity of the 1E1-1 seat/ballast block center of gravity was determined to lie 0.72 inches (1.8 cm) below the rocket thrustline (figure 29). Since the STAPAC rocket is capable of maintaining pitch stabilization of the seat up to an eccentricity of 2.0 inches (5.1 cm) the seat should be adequately stabilized.

The 1E1 ejection seat was designed so that the MK16 rocket thrustline lies about one inch below the seat/50 percentile-man center of gravity. During catapult acceleration the overall center of gravity will shift close to the rocket thrustline to minimize the torque rotating the seat. It is expected that the Ballast Block Assembly will not shift more than 1/8 inch (0.3 cm) downward during the catapult acceleration, and therefore the seat/block center of gravity will shift about half of this amount.

Pitch stabilization is further enhanced due to the lower moment of inertia of the seat/block compared to that of a seat/human, therefore the STAPAC rocket will have greater control on the seat at lower air speeds. At high airspeeds the aerodynamic forces control the seat trajectory more than the rocket force.

CENTER OF GRAVITY OF 1E-1 SEAT WITH S-3A BALLAST BLOCK

TEST CONDITIONS:

1. Ballast Block assembly tested without fore and aft extensions on bottom block.
2. IG-2 ESCAPAC seat used with parachute, empty RSSK, and empty catapult.
3. All measurements made from lower seat roller; Z along roller centerline.

DATA:

Weight of Ballast Block	W_B = 164.0 pounds
Weight of IG-2 seat	W_{IG-2} = 108.3
Weight of 1E1-1 seat complete (empty)	W_{1E1} = 146.9
C.G. of IG-2 seat with Block	($\underset{X}{12.9}$, $\underset{Z}{14.7}$) inches
C.G. of IG-2 seat empty	(7.9, 17.2)
C.G. of 1E-1 seat complete (empty)	(7.9, 15.0)

MK 16 Rocket thrustline intercepts roller centerline 6.8 inches above bottom roller; 57 degrees from roller centerline

CALCULATIONS:

I LOCATION OF BLOCK C.G. RELATIVE TO BOTTOM ROLLER OF IG-2 SEAT

$$W_{IG-2} \cdot x_{IG-2} + W_B \cdot X_B = W_{IG-2/B} \cdot x_{IG-2/B}$$

$$(108.3)\ 7.9 + 164.0\, X_B = (108.3 + 164.0)\ 12.9$$

$$X_B = 16.2$$

$$W_{IG-2} \cdot Z_{IG-2} + W_B \cdot Z_B = W_{IG-2/B} \cdot Z_{IG-2/B}$$

$$(108.3)\ 17.2 + 164.0\, Z_B = (108.3 + 164.0)\ 14.7$$

$$Z_B = 13.0$$

II LOCATION OF 1E-1 SEAT/BALLAST BLOCK CENTER OF GRAVITY

$$W_{1E-1} \cdot X_{1E-1} + W_B \cdot X_B = W_{1E1-1/B} \cdot X_{1E-1/B}$$

$$(146.9)\ 7.9 + (164.0)\ 16.2 = (146.9 + 164.0)\, X_{1E-1/B}$$

$$X_{1E-1/B} = 12.3$$

$$W_{1E-1} \cdot Z_{1E-1} + W_B \cdot Z_B = W_{1E-1/B} \cdot Z_{1E-1/B}$$

$$(146.9)\ 15.0 + (164.0)\ 13.0 = (310.9)\, Z_{1E-1/B}$$

$$Z_{1E-1/B} = 13.9$$

III ROCKET THRUST ECCENTRICITY WITH 1E-1 SEAT/BLOCK CENTER OF GRAVITY

slope of rocket thrustline $m = \tan(90° - 57°) = .649$

slope of perpendicular to thrustline $m_{\perp} = -\frac{1}{M} = -\frac{1}{.649} = -1.54$

rocket thrustline equation $Z = 0.649\ x + 6.8$

line perpendicular to thrustline thru 1E-1/block C.G.

$$Z = -1.54\ x + b$$
$$13.9 = -1.54\ (12.3) + b$$
$$b = 32.8$$
$$Z = -1.54\ x + 32.8$$

INTERCEPT OF BOTH LINES (ROCKET THRUST AND PERPENDICULAR)

$$\begin{cases} Z = 0.649\ x + 6.8 & Z = 0.649\ (11.9) + 6.8 \\ Z = -1.54\ x + 32.8 & Z = 14.5 \text{ inches} \end{cases}$$

$$2.19\ x = 32.8 - 6.8$$

$$X = 11.9 \text{ inches}$$

C.G. ECCENTRICITY

$$e = \left[(Z_2 - Z_1)^2 + (X_2 - X_1)^2\right]^{1/2}$$

$$e = \left[(14.5 - 13.9)^2 + (11.9 - 12.3)^2\right]^{1/2}$$

$e = 0.72$ inches below thrustline

ASSEMBLY AND DISASSEMBLY ON THE 1E-1 SEAT AND ON THE AISLE STEP

Two blocks at a time can be carried to the aircraft by one crewmember (figure 3).

The first block (−1 Block) should be placed on the RSSK-8A survival kit so that the aft tabs rest against the survival kit back fittings (figure 8). After the other three blocks are stacked onto the seat (figure 9) the shoulder restraint straps are routed up through the block handles and connected to the parachute risers (figures 10,11). Then the 'lap belt' on the top block is connected to the survival kit straps (figures 12, 13). All straps are then tightened, and the inertia reel lever is placed in the 'lock' position.

When the Assembly is to be stowed on the avionics aisle step the −1 Block is placed with the handle towards the aircrafts' port side, and the block tangs slide under the lip of the step bulkhead (figure 14). The other three blocks are then stacked on top (figures 15, 16, 17), then the top locking plates are slid into the bulkhead forgings and secured by the two wing nuts (figures 18, 19, 20).

EJECTION SEAT STATIC LOADS

The existing seat lap belt/shoulder harness straps are used to restrain the Ballast Block Assembly. Since these straps are qualified for crash loads it was decided that one test would be sufficient to verify structural integrity of the assembly on the seat.

Forward – A forward load of 1000 pounds was applied to the block assembly simulating a –6 Gx arrested landing; no problems were encountered (figure 5).

Aft – When subjected to catapult loads the Block Assembly is prevented from moving aft by the lap belt strap and seat back. No test was conducted.

Vertical – For vertical loads the Assembly is restrained by the lap belt and seat bucket which are capable of handling all Gz flight or crash design loads on the aircrewman. No test was conducted.

Lateral – Lateral stability is assured by the bottom block side tabs (figure 8) which limit the block center of gravity movement to about 1/2 inch (1.3 cm); this translates to less than 1/4 inch (0.6 cm) of seat/block center of gravity movement. No test was conducted.

AISLE POSITION STATIC LOADS

Aft (Catapult) Loads (figure 6) – A ratchet winch was used to place a 1000 pound aft load on the block assembly to simulate a +6 Gx catapult launch. No problems were encountered.

Forward (Arrestment) Loads – No test was conducted because the Block Assembly contacts the lower section of the avionics bay bulkhead. The entire center aircraft structure would have to fail before the Block Assembly could break loose.

Upward (–Gz) Flight Loads (figure 7) – A ratchet winch was used to place a 500 pound upward load on the Assembly to simulate a –2Gz flight load. This exceeds the design flight loads of the aircraft. No problems were encountered.

Side (± Gy) Loads (figure 20) – The aisle locking plates limit the lateral motion of the top block to ± 1/4 inch (1 centimeter). The bottom block is limited to the same motion before contacting the sides of the aisle. No tests were necessary.

Downward (+Gz) Crash Loads – There is a requirement that all new equipment installed in the aircraft must be capable of withstanding a crash load of 10G without breaking loose from its support points. Since the bottom block of the assembly completely spans the avionics bay step the foam core aluminum step has no bending loads. All the load can easily be taken into the angles which support the step (figure (14). Even if the step should fail the Block Assembly would be limited in its vertical motion because of the electronic equipment directly beneath the step. No actual test was conducted.

CONCLUSIONS

1. The S-3A Ballast Block meets all operational and structural requirements for safe utilization in the aircraft.

2. The Ballast Block provides a simple and cost effective replacement for the anthropomorphic dummies presently being used to ballast unoccupied 1E-1 ejection seats.

ACKNOWLEDGEMENTS

Special thanks are due to CMDR Dick Asbell (Air 5113K), the sponsor of this project, for his guidance; to the personnel of the Naval Air Test Center responsible for test and evaluation, LT. CMDR Dave Architzel, CMDR R. H. Johnston, and Bob Rogers; to the NADC shop personnel for their design improvements and an excellent job of fabrication, Bill Funkbeiner, R. Pete Butkus, and John Rudolph.

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1. Lorch, Dan, 4 Nov 1981, Development of An Ejection Seat Ballast Block for the S-3A Aircraft, Report No. NADC-81272-60 Naval Air Development Center, Warminster, PA 18974.

2. Stark, G/Sparks, T., AME 1, July 1981 Feasibility Evaluation of Proposed S-3A Aircraft Ejection Seat Ballast Block Report No. SY-62R-82 Naval Air Test Center, Patuxent River, MD 20670.

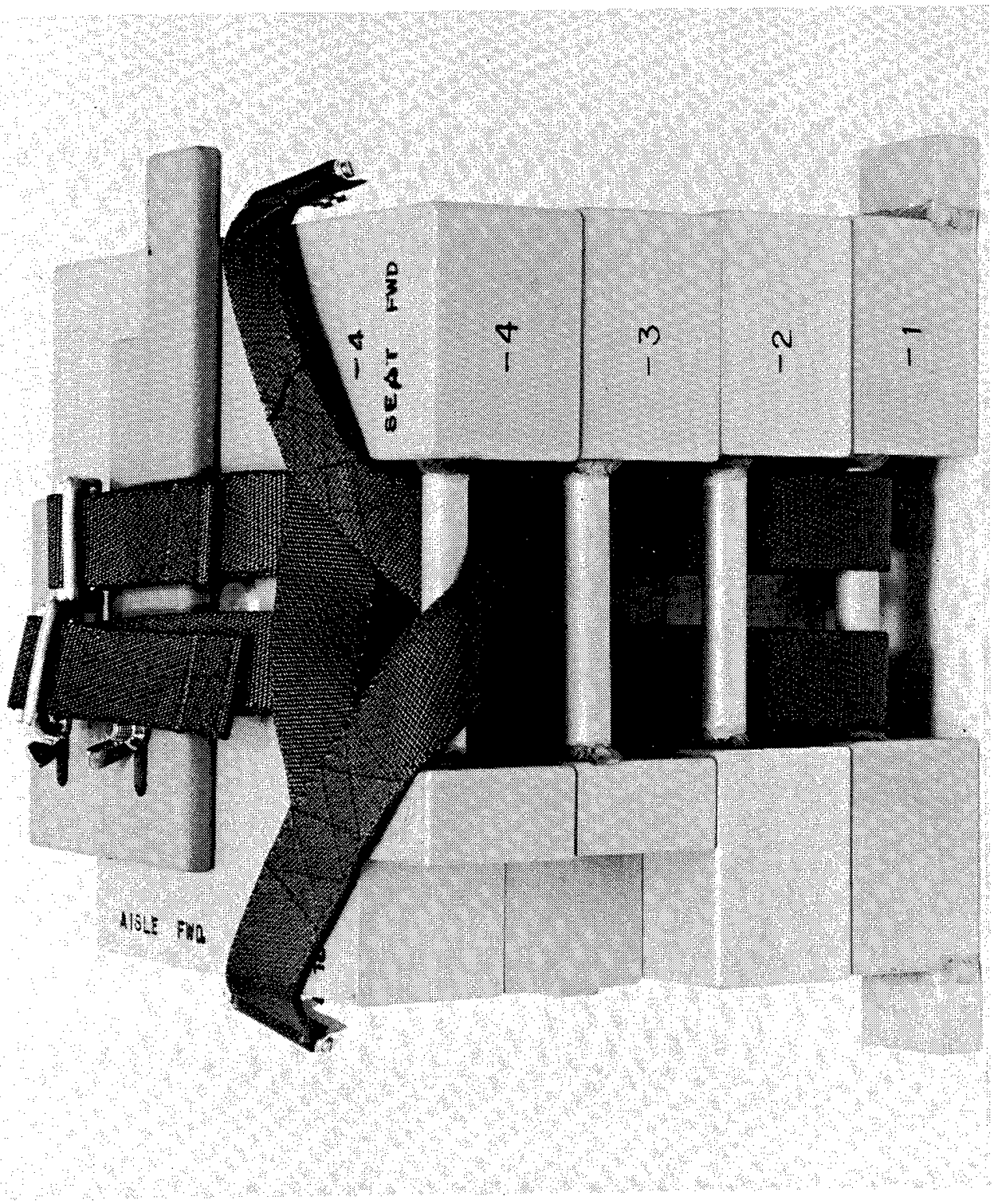


Figure 1. S-3A Ballast Block Assembled

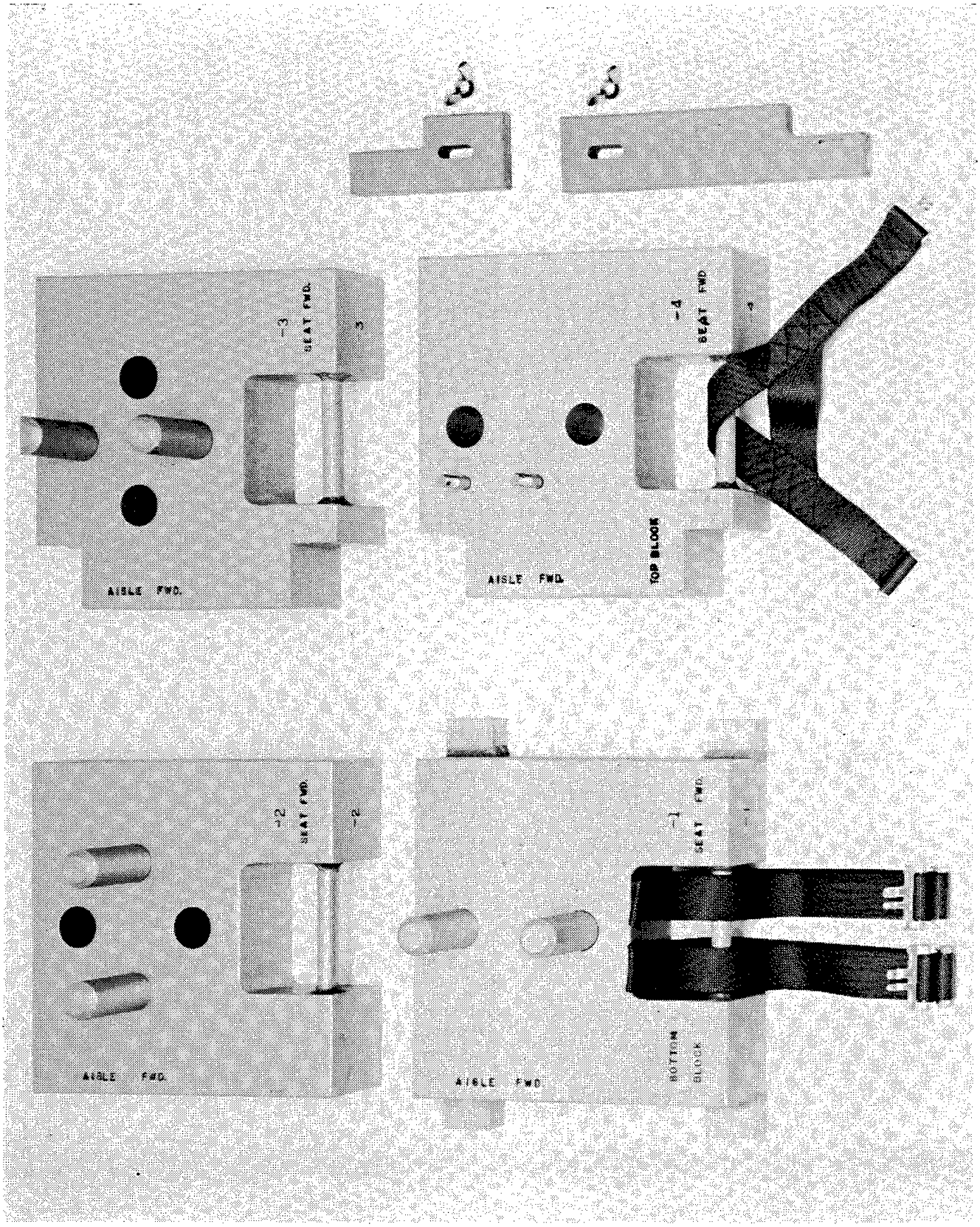


Figure 2. S-3A Ballast Block Disassembled

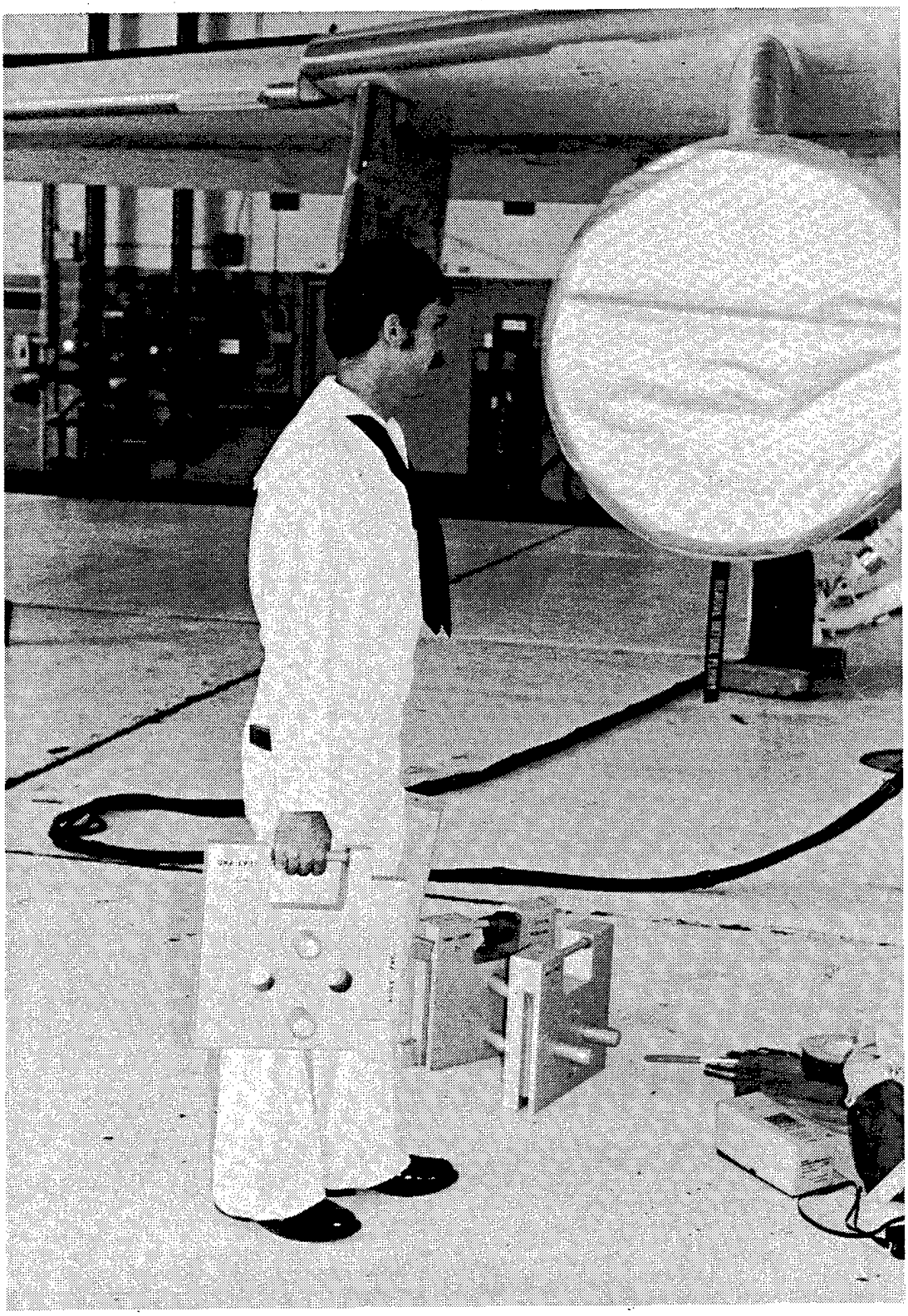


Figure 3. Crewman Carrying Ballast Block Components

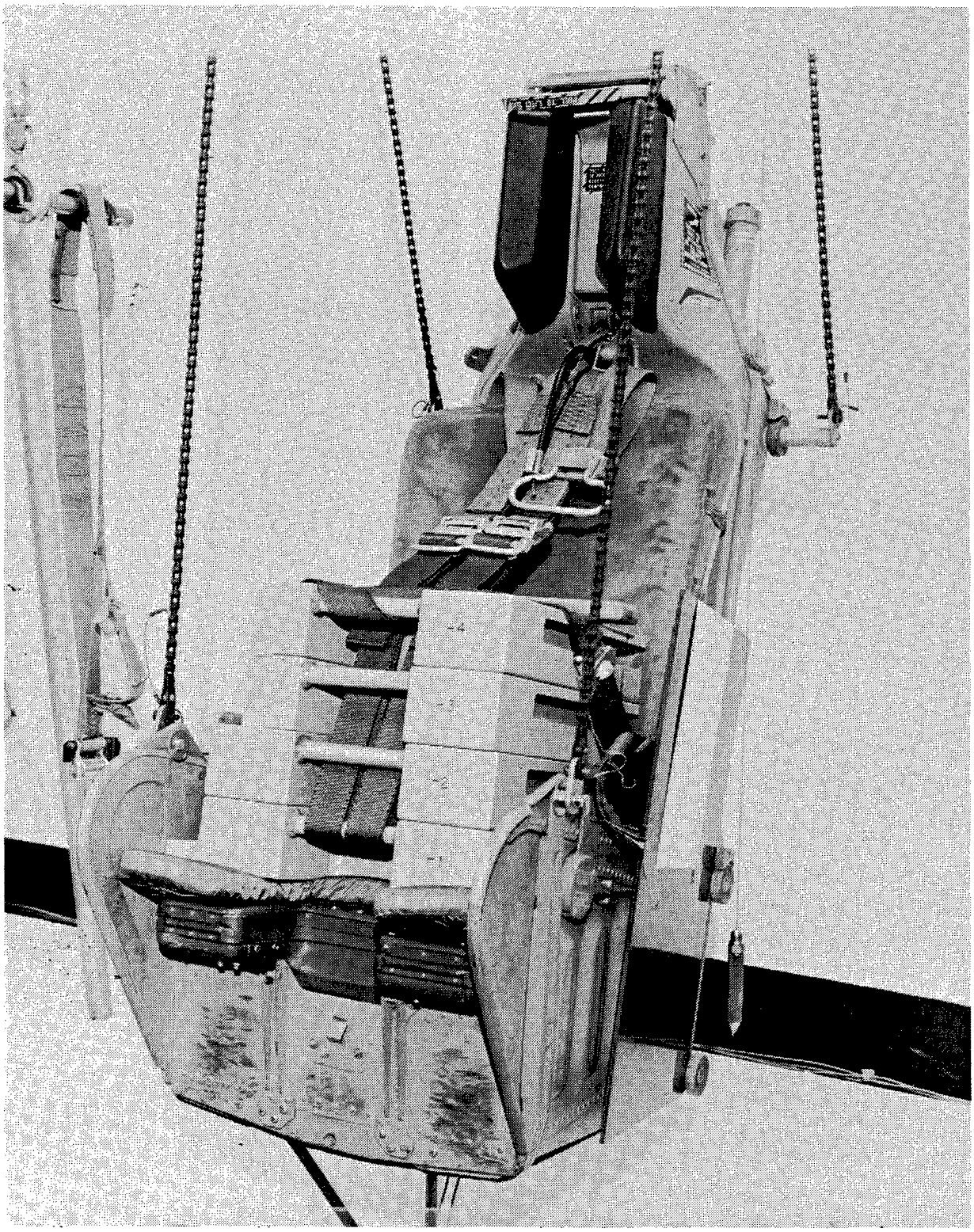


Figure 4. Center of Gravity Measurement

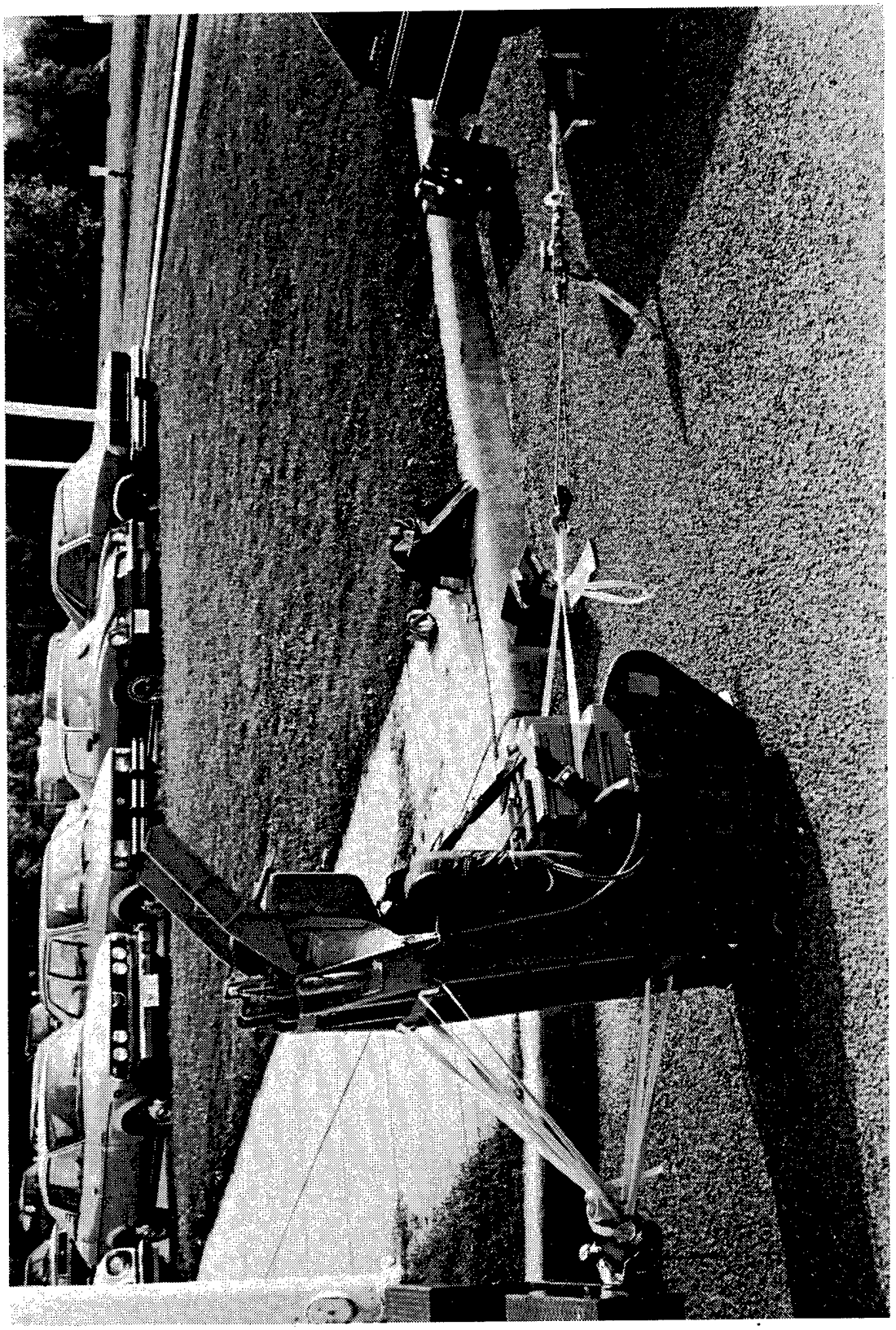


Figure 5. 1000 Pound -G_X Load On Seat

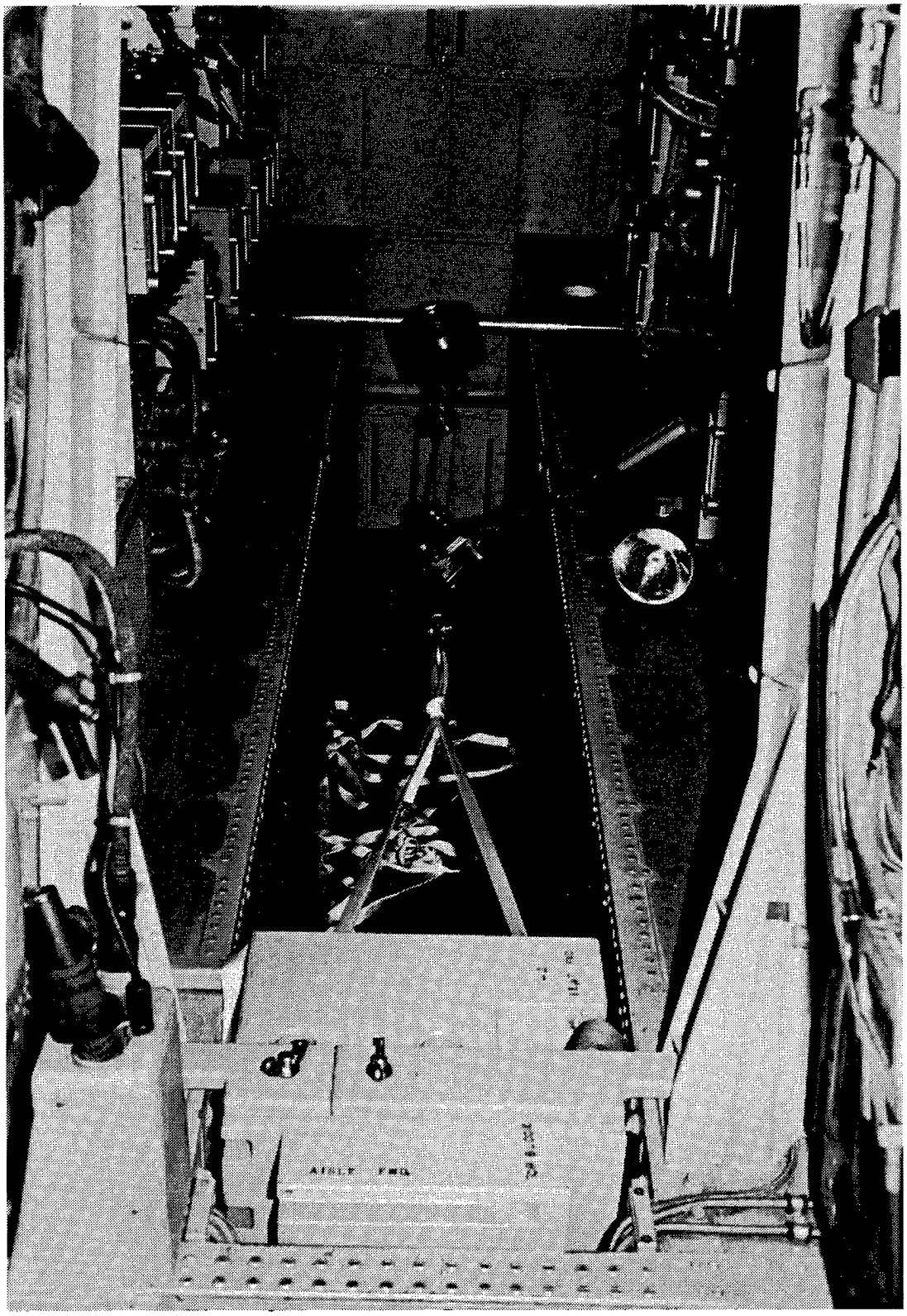


Figure 6. 1000 Pound $+G_X$ Load in Aisle

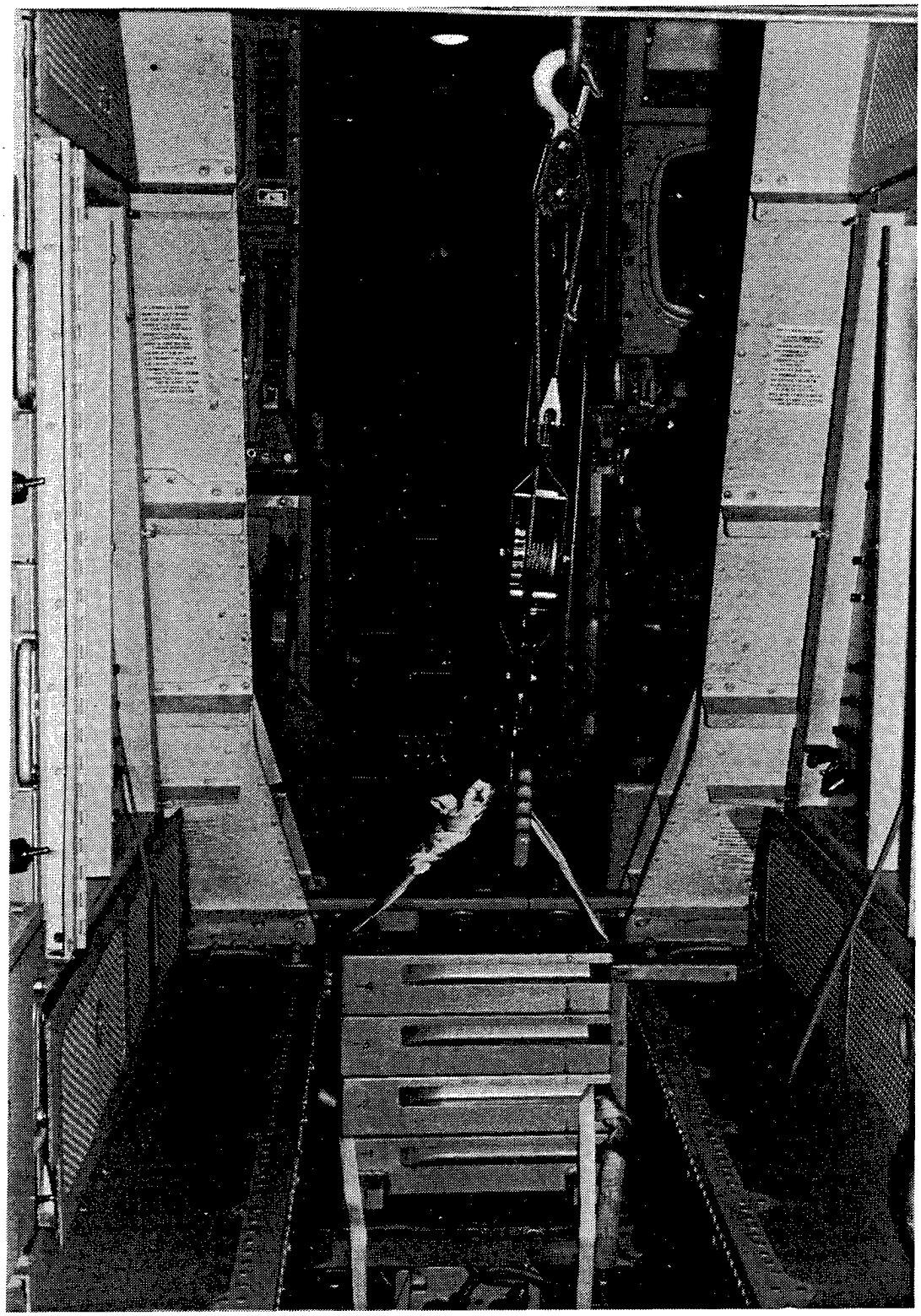


Figure 7. 500 Pound $-G_z$ Load in Aisle

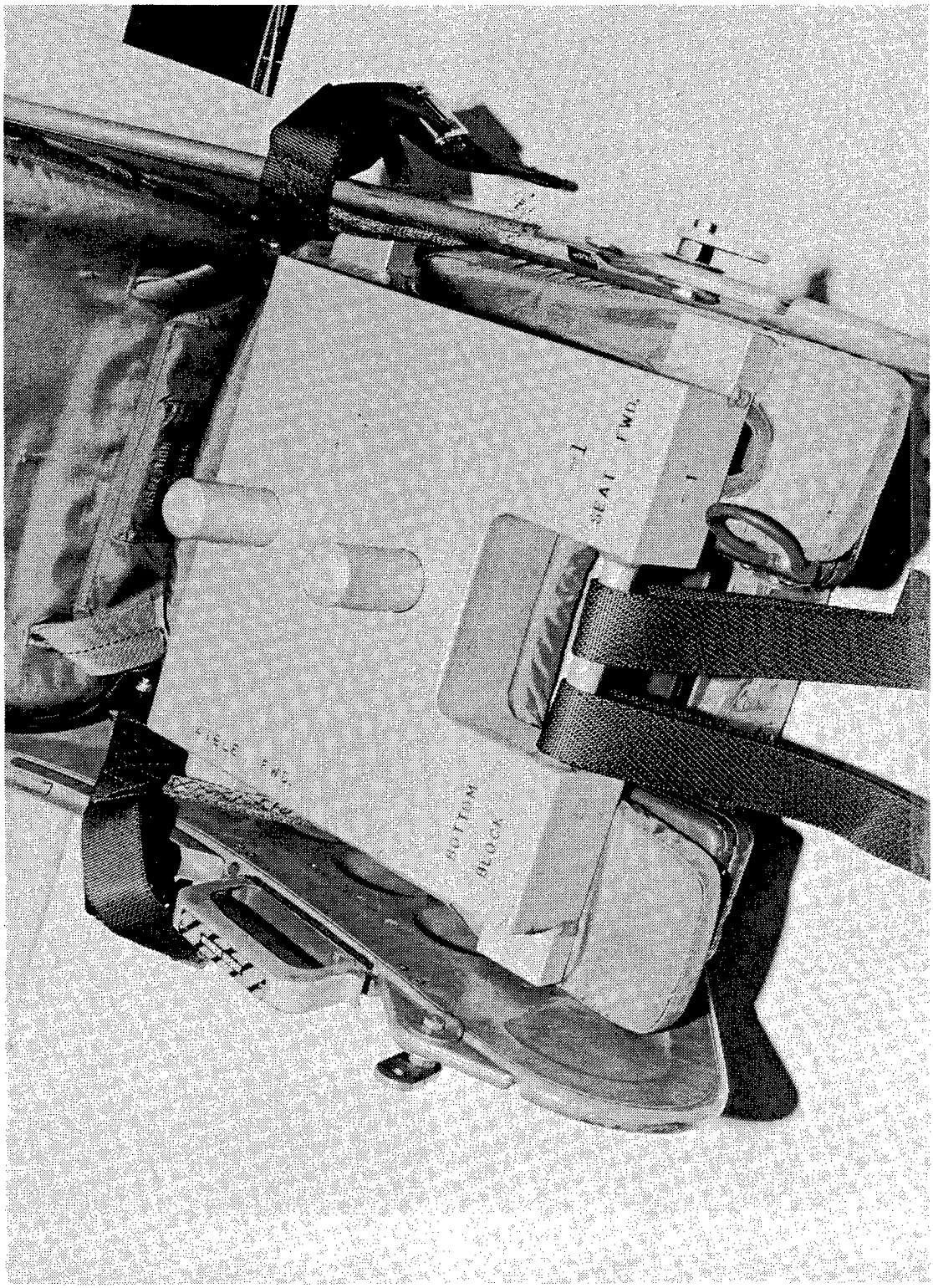


Figure 8. —1 Bottom Block in Seat

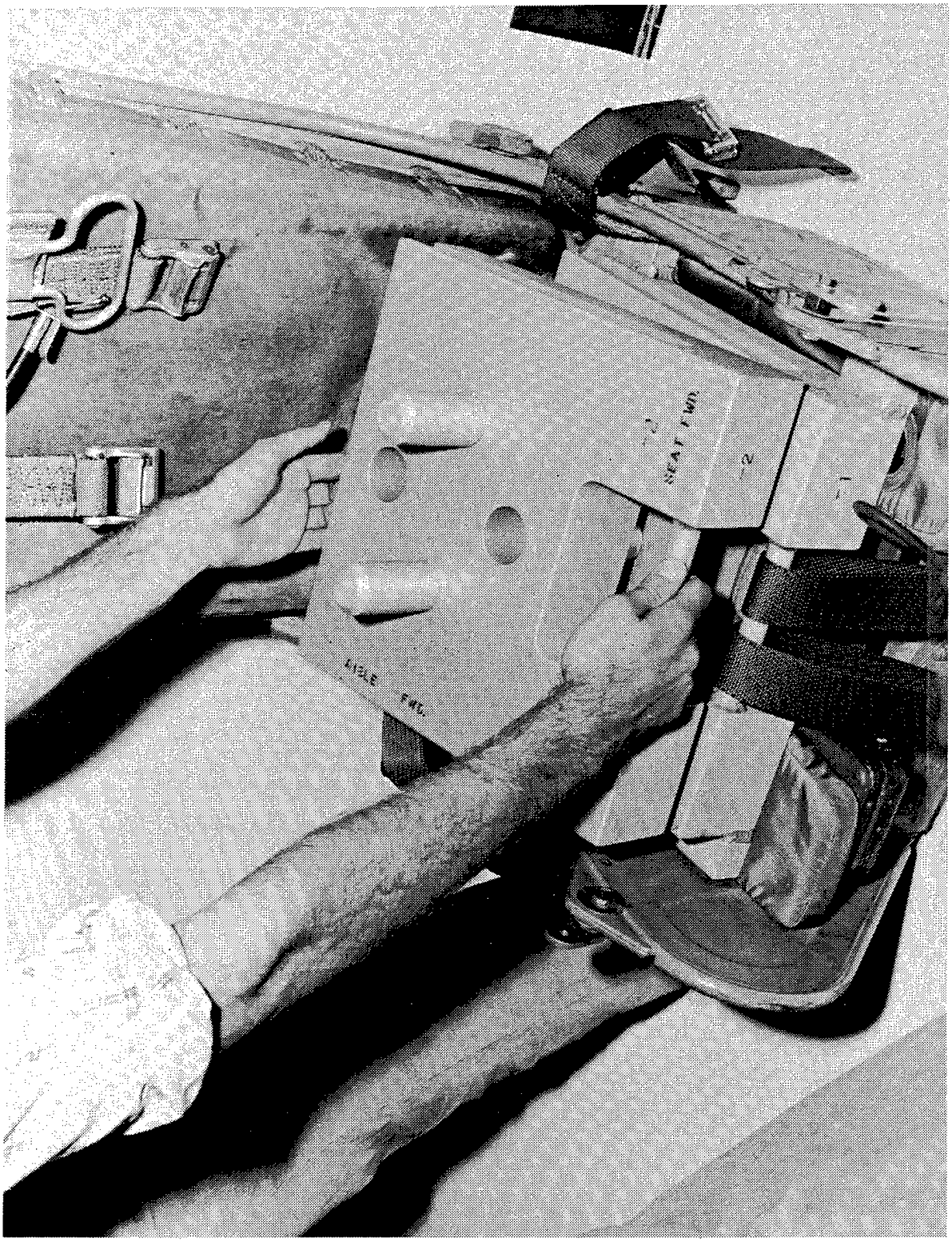


Figure 9. —2 Block Placed in Seat

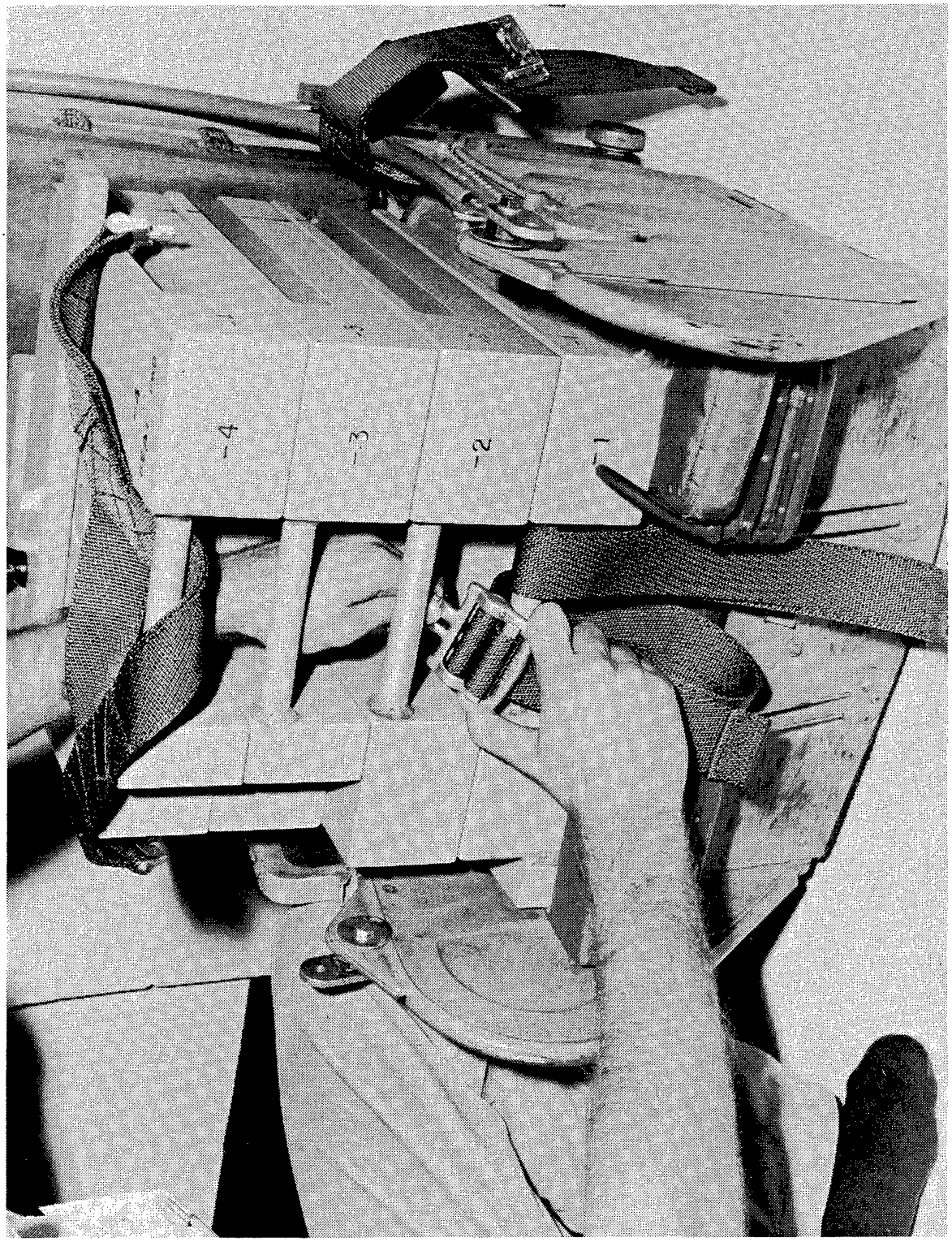


Figure 10. Routing of Shoulder Restraint Straps

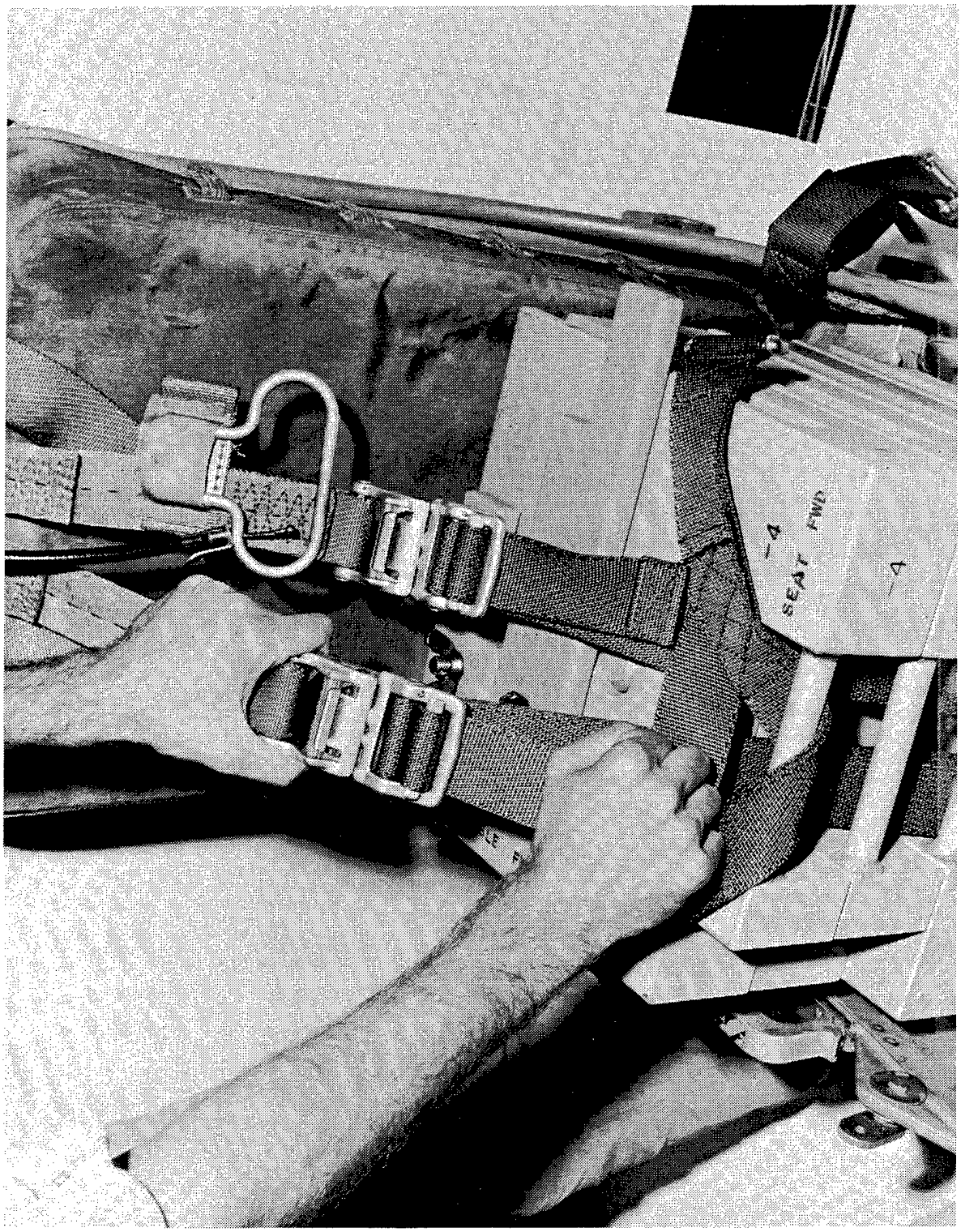


Figure 11. Connecting Parachute Riser Straps

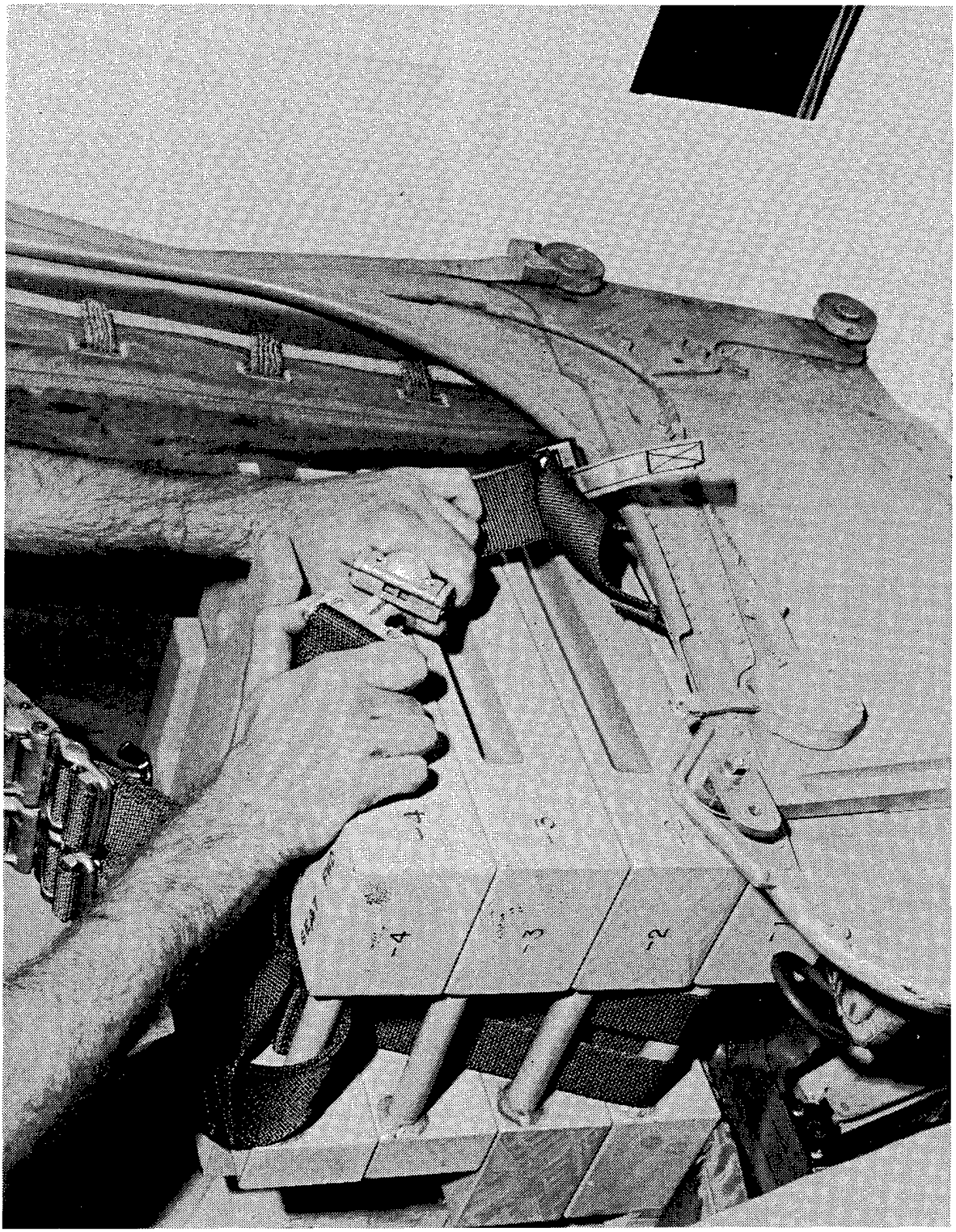


Figure 12. Connecting Lap Belt Fittings

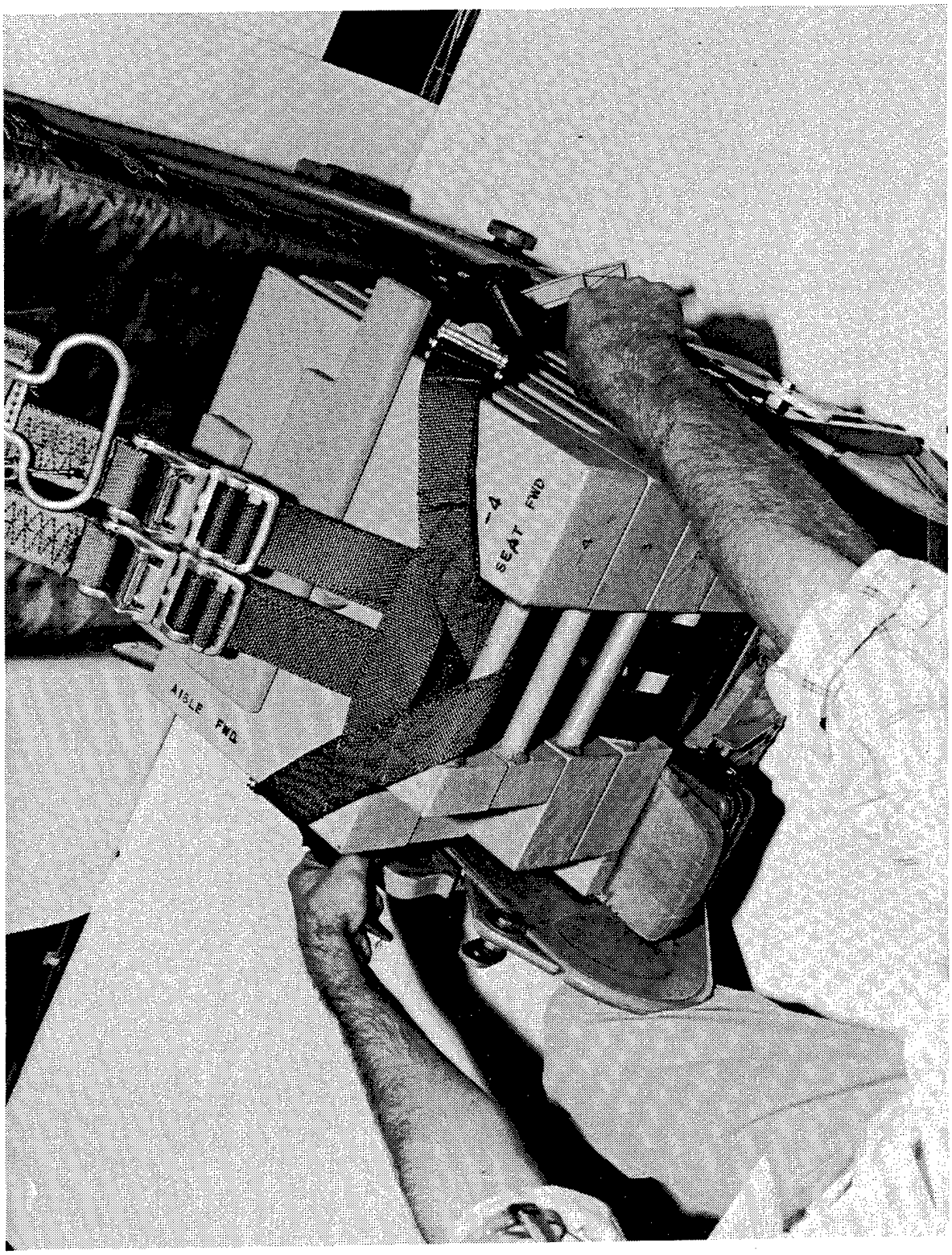


Figure 13. Tightening Straps on Seat

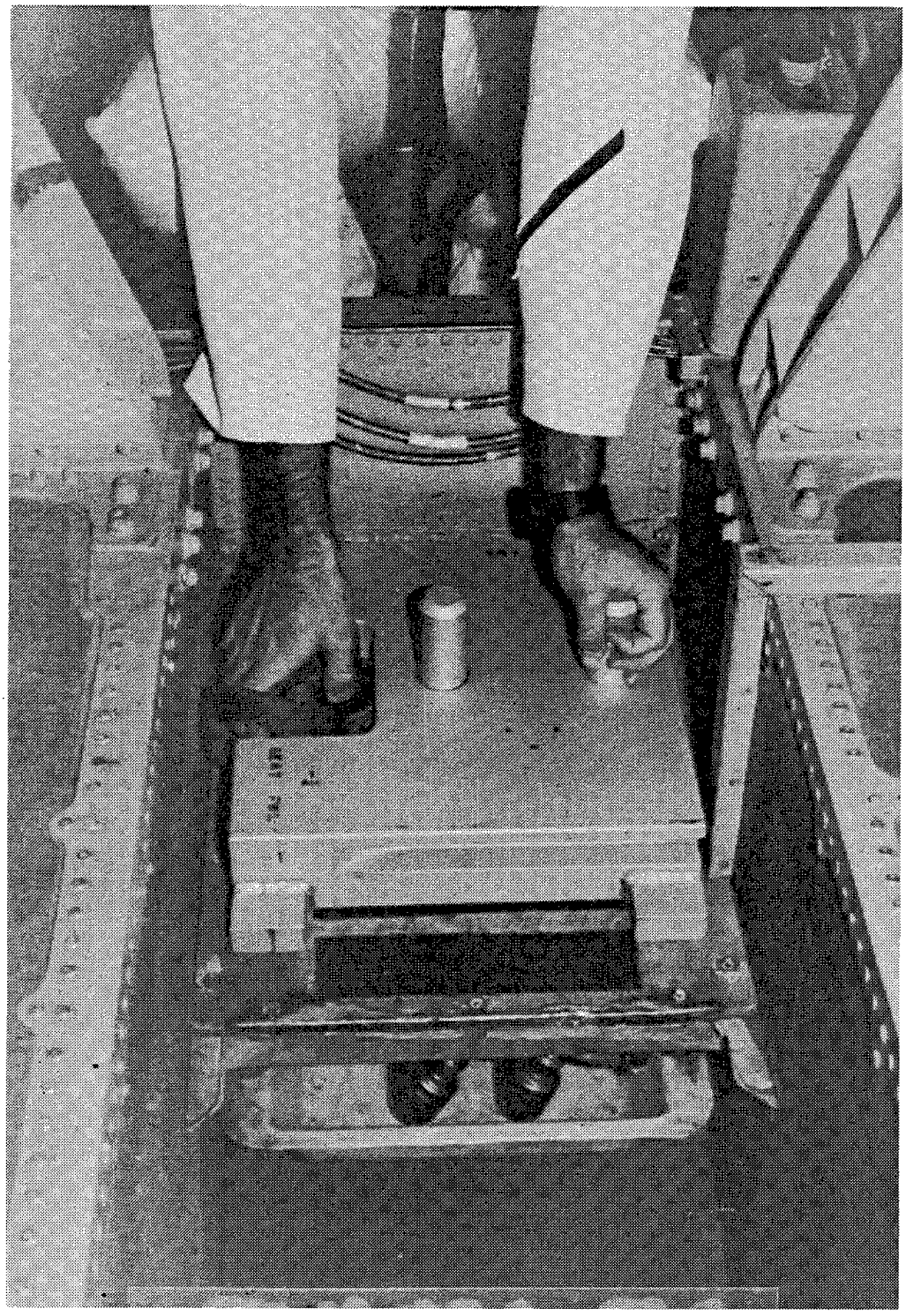


Figure 14. –1 Block on Aisle Step

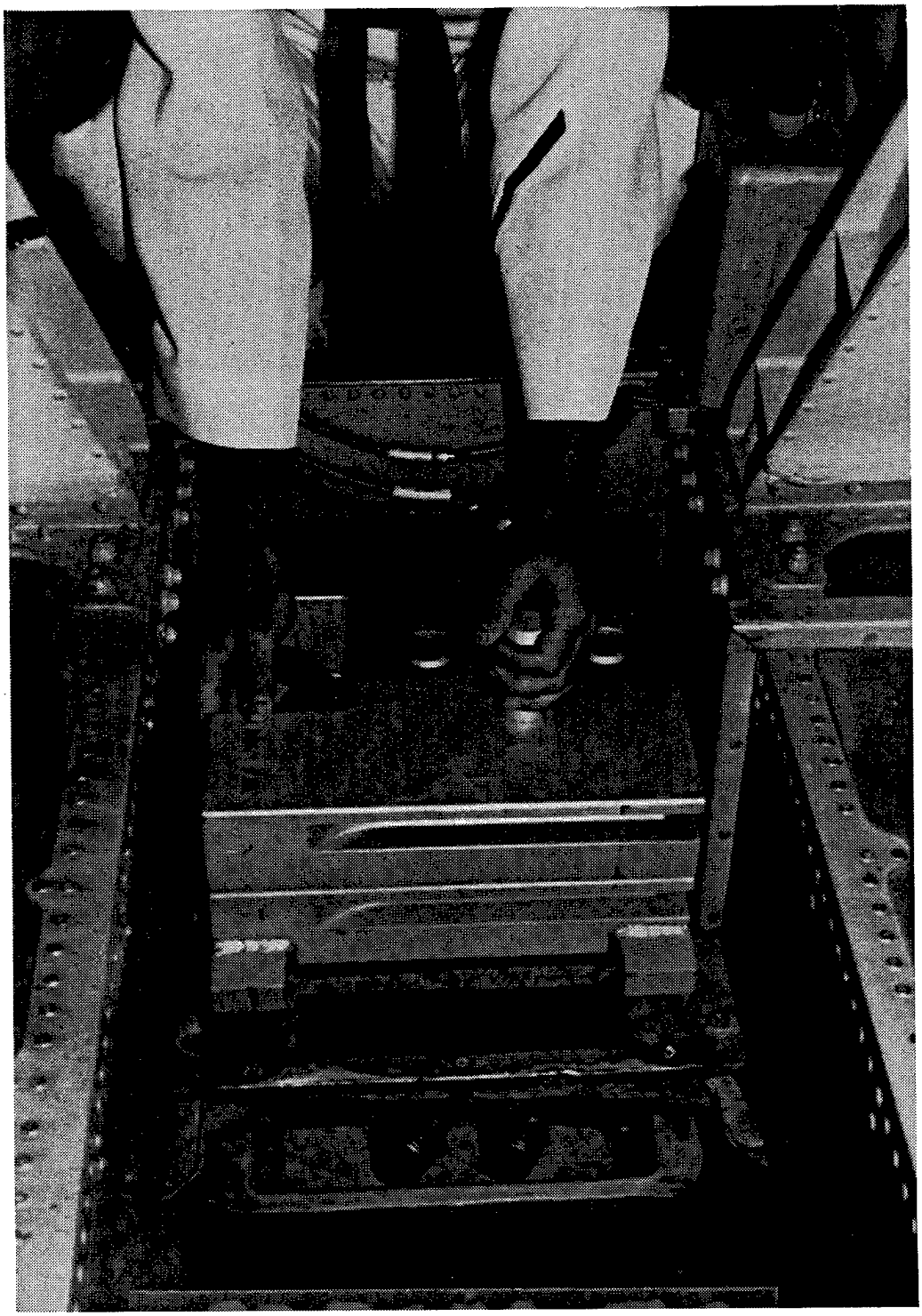


Figure 15. –2 Block on Aisle Step

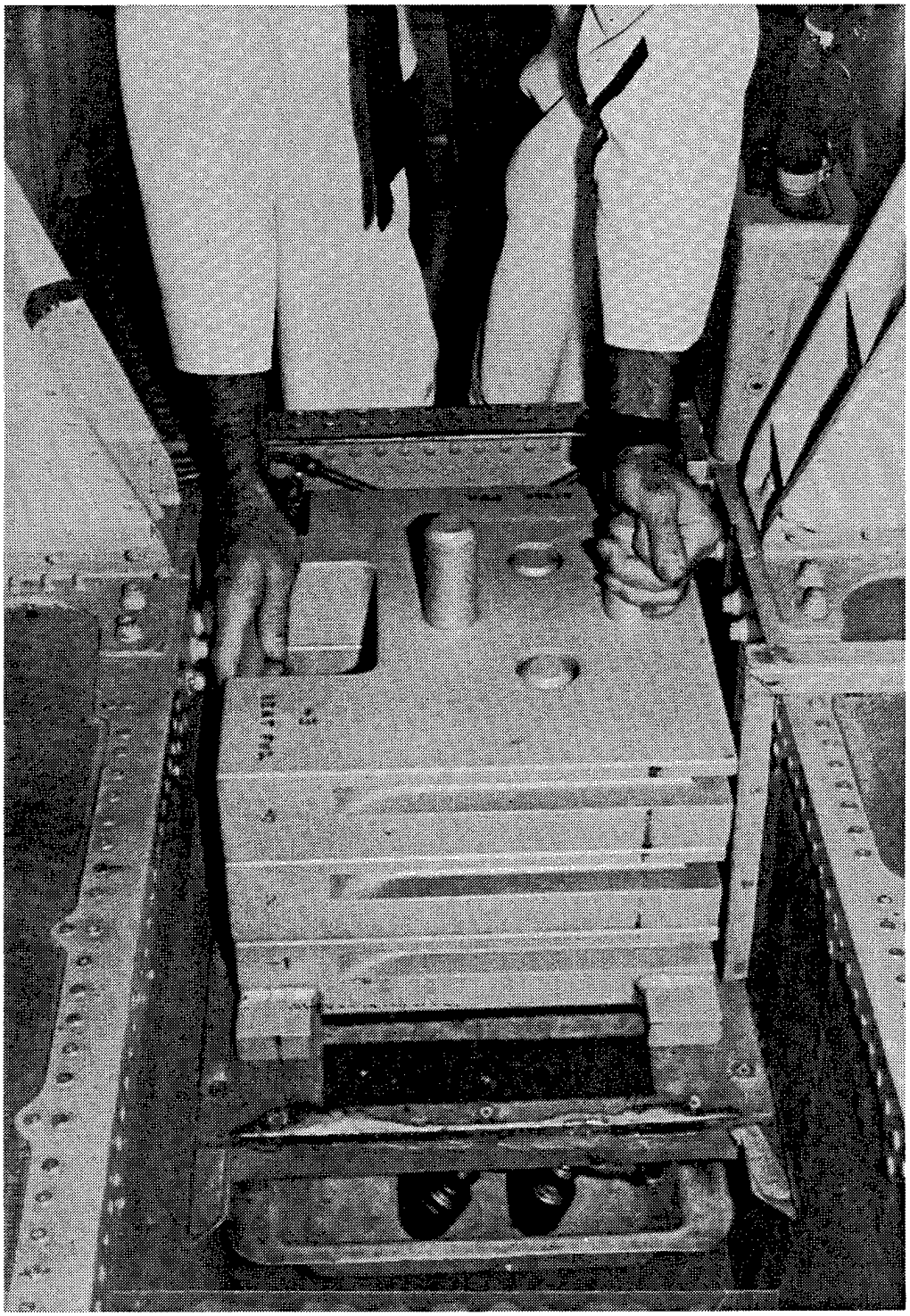


Figure 16. –3 Block on Aisle Step

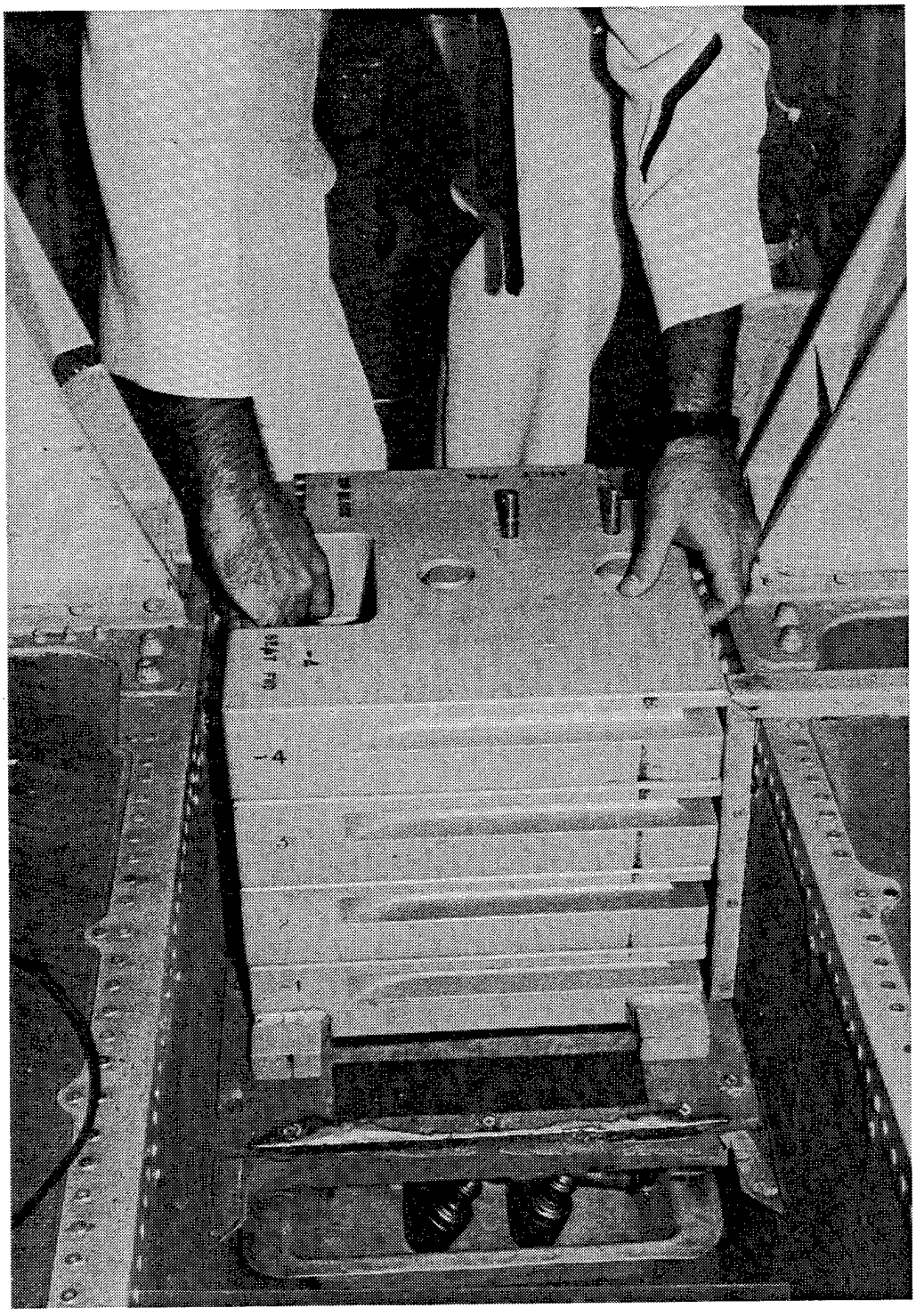


Figure 17. –4 Block on Aisle Step

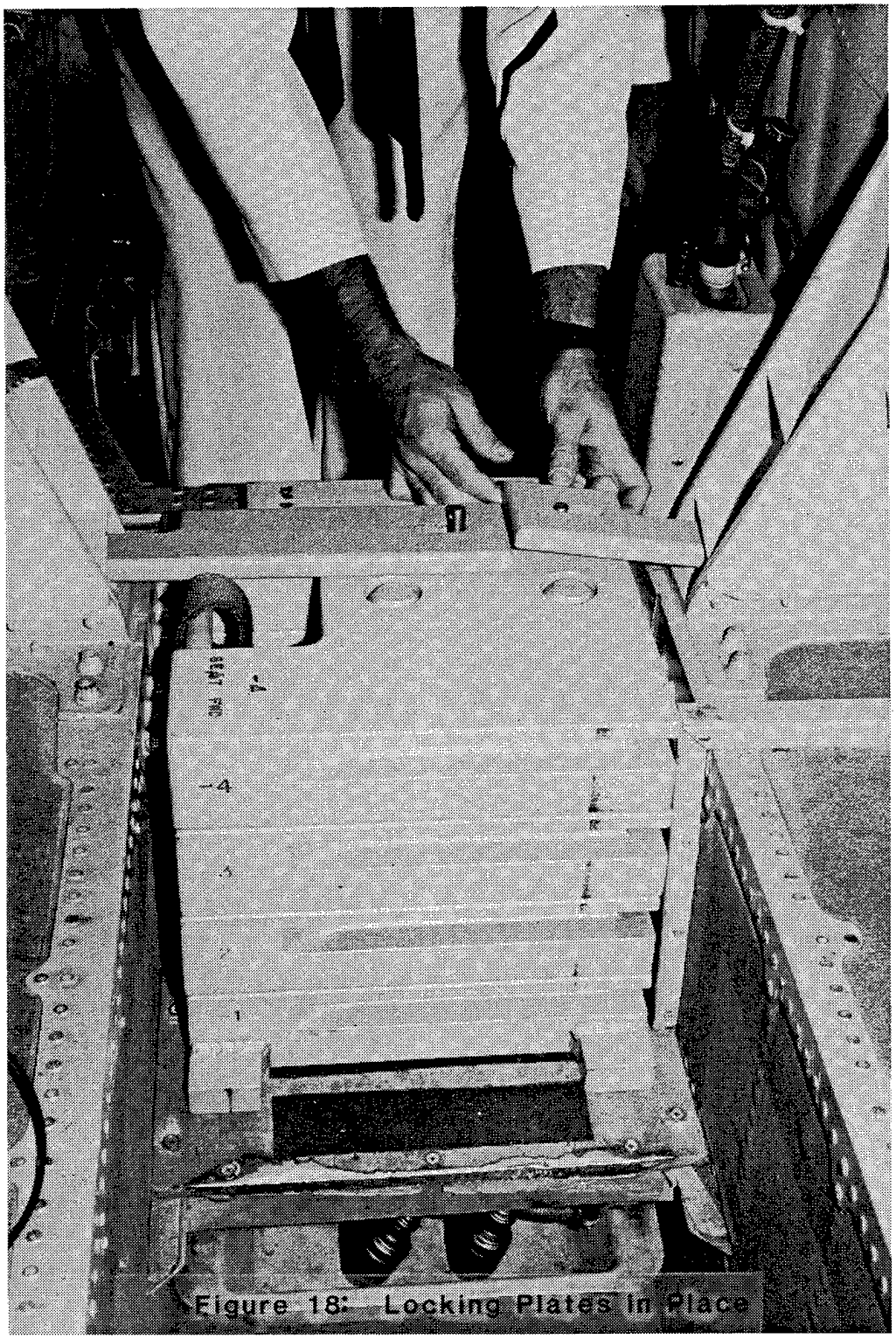


Figure 18. Lock Plates in Place

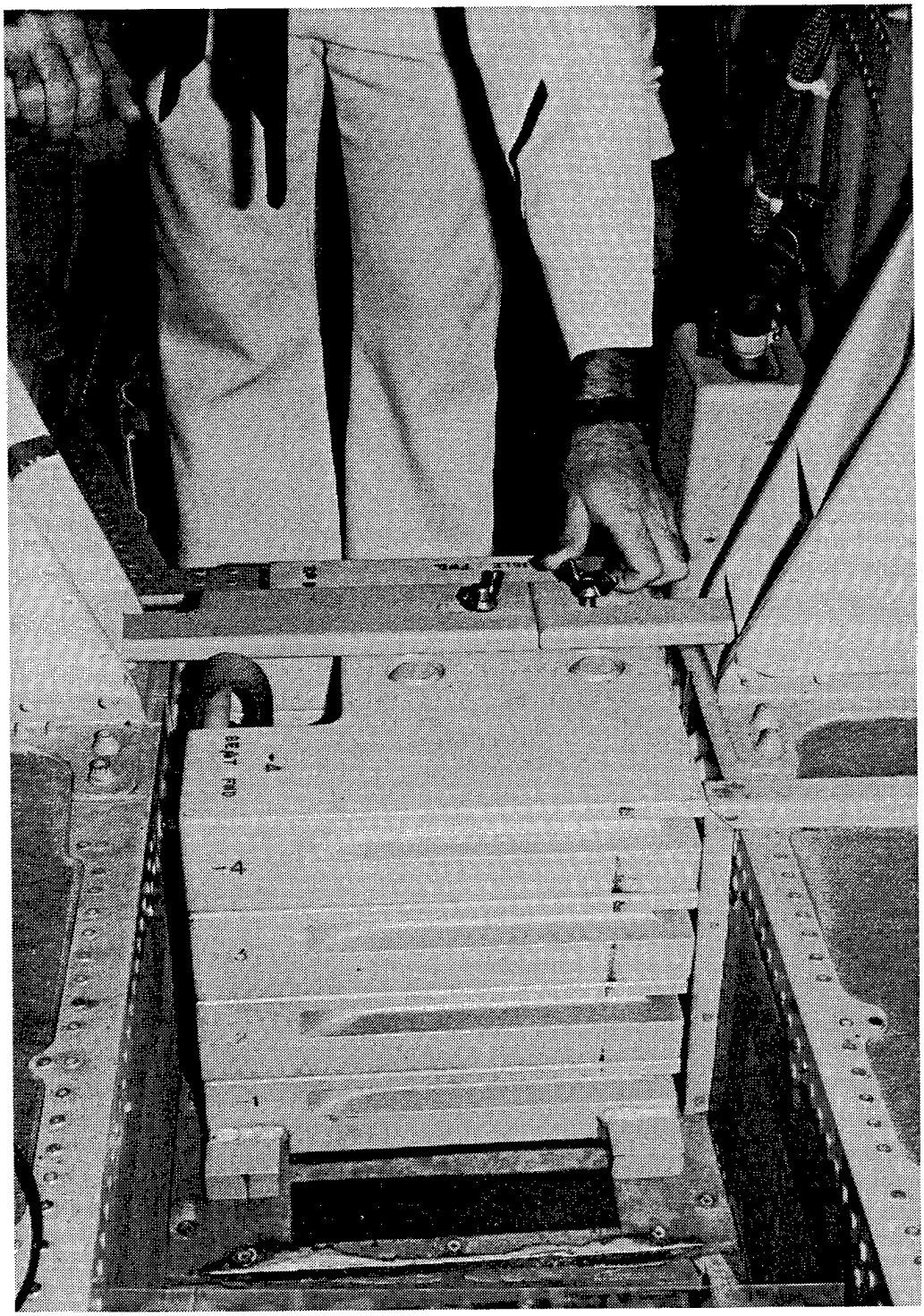


Figure 19. Wing Nuts on Locking Plates

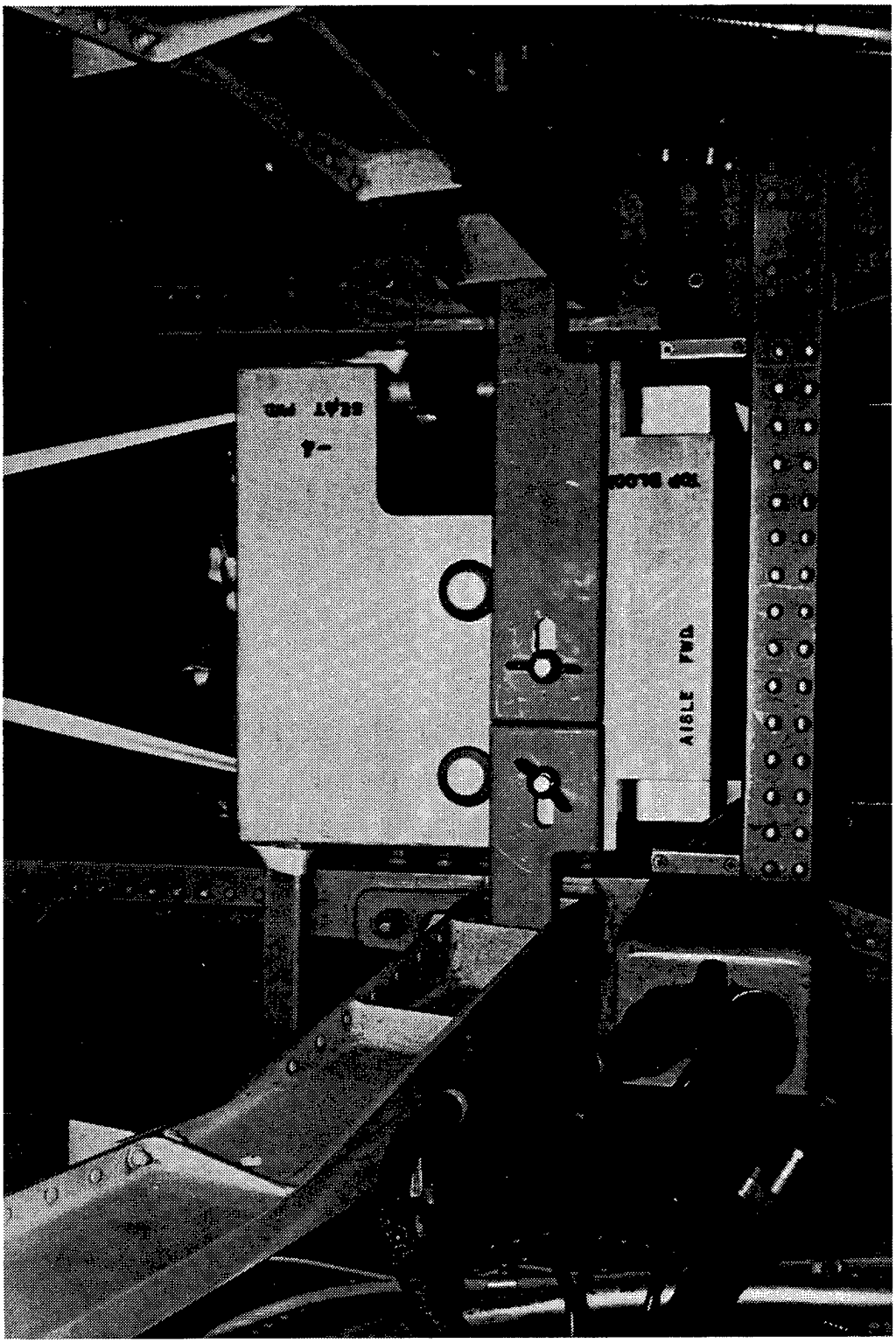
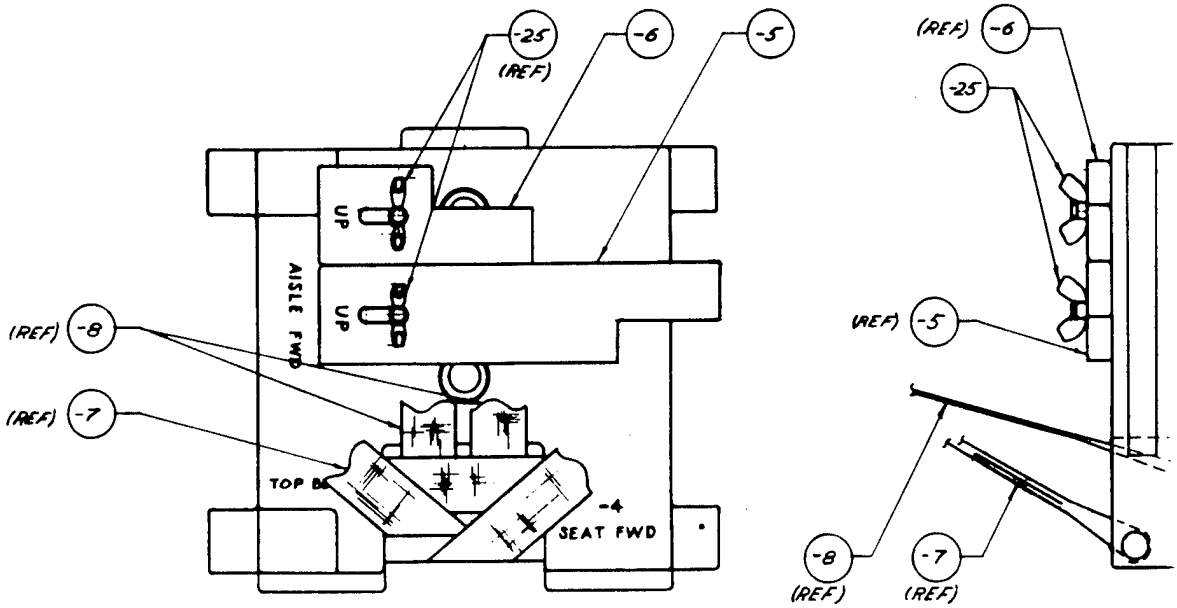


Figure 20. Top View of Assembly in Aisle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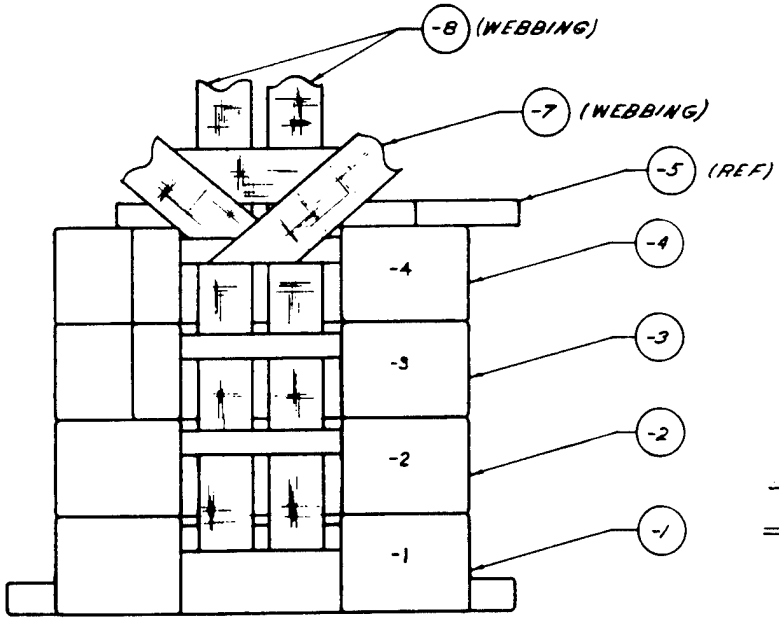
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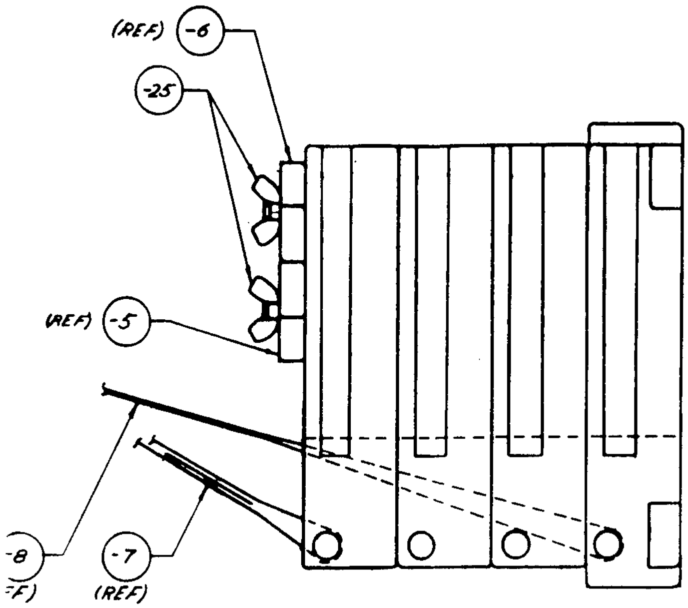
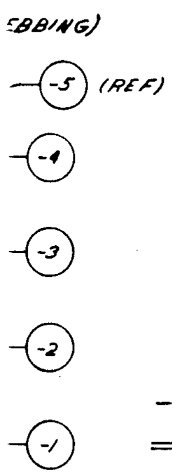




-101 S-3A BALLAST BLOCK ASSY.

NO. REQ'D	PART NO.	NAME OF PART	MATE
2	-25	WING NUT	STE CADMIU
2	-24	BOLT	STEEL CADM
4	-22	TAB	6061- ALUM
4	-21	PLUG	
4	-20	HANDLE	
6	-19	POST	
1	-18	BLOCK	
1	-17	BLOCK	
1	-16	BLOCK	
1	-15	BLOCK	6061- ALUM
2	-14	SHOULDER HARNESS QUICK RELEASE FTNG	
2	-13	LAP BELT QUICK RELEASE FITTING	
AR	-12	THREAD	NYLON 6 COR
2	-11	STRAP	NYLON, WEBB
1	-10	CROSS STRAP	
1	-9	STRAP	NYLON, WEBBI
2	-8	SHOULDER HARNESS STRAP ASSY.	
1	-7	LAP BELT STRAP ASSY.	
1	-6	LOCKING PLATE	6061- ALUMI
1	-5	LOCKING PLATE	6061- ALUM
1	-4	BLOCK ASSY.	
1	-3	BLOCK ASSY.	
1	-2	BLOCK ASSY.	
1	-1	BLOCK ASSY.	
X	-101	S-3A BALLAST BLOCK ASSY.	

LIST OF A

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± ANGLES ± 2 PLACE DECIMALS ± 3 PLACE DECIMALS ±	CONTRACT NO.
DO NOT SCALE THIS DRAWING	DRAWN J. QUARTUCCIO 11/28/83
MATERIAL:	CHECKED [signature] 11/28/83
	APPROVED
	APPROVED

Figure 21. Dwg, S-3A Ballast Block, Assembly

2

NADC-84015-60

REVISIONS					
ZONE	LTR	DESCRIPTION		DATE	APPROVED

NO. REQ'D	PART NO.	NAME OF PART	MATERIAL	SIZE	SPECIFICATION
2	-25	WING NUT	STEEL, CADMIUM PLATE	$\frac{1}{2}$ DIA	MS35426 -18
2	-24	BOLT	STEEL, CADMIUM PLATE	$\frac{1}{2}$ DIA, $3\frac{1}{2}$ GRIP	AN-8-36
4	-22	TAB	6061-T651 ALUMINUM	1.00 x 1.50 x 2.00	
4	-21	PLUG		$\frac{13}{16}$ DIA x 1.00	
4	-20	HANDLE		$\frac{3}{4}$ DIA x 9.00	
6	-19	POST		1.50 DIA x 5.90	
1	-18	BLOCK		3.00 x 13.00 x 13.00	
1	-17	BLOCK			
1	-16	BLOCK		3.00 x 13.00 x 13.00	
1	-15	BLOCK	6061-T651 ALUMINUM	3.00 x 13.00 x 14.12	
2	-14	SHOULDER HARNESS QUICK RELEASE FTNG			P/N 015-710001-1 (KOCH)
2	-13	LAP BELT QUICK RELEASE FITTING			P/N 015-11366-1 (KOCH)
AR	-12	THREAD	NYLON, SAGE GRN 6 CORD		V-T-295 NIIN 00-559-5211
2	-11	STRAP	NYLON, SAGE GRN WEBBING	$1\frac{3}{4}$ x 54.0	MIL-W-4088 TY XIII
1	-10	CROSS STRAP		$1\frac{3}{4}$ x 11.0	
1	-9	STRAP	NYLON, SAGE GRN WEBBING	$1\frac{3}{4}$ x 44.0	MIL-W-4088 TY XIII
2	-8	SHOULDER HARNESS STRAP ASSY.			
1	-7	LAP BELT STRAP ASSY.			
1	-6	LOCKING PLATE	6061-T651 ALUMINUM	.75 x 3.00 x 6.75	
1	-5	LOCKING PLATE	6061-T651 ALUMINUM	.75 x 3.00 x 12.75	
1	-4	BLOCK ASSY.			
1	-3	BLOCK ASSY.			
1	-2	BLOCK ASSY.			
1	-1	BLOCK ASSY.			
X	-101	S-3A BALLAST BLOCK ASSY.			

LIST OF MATERIALS

CK ASSY.

ssembly

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± ANGLES ± 2 PLACE DEC. HOLES ± 3 PLACE DEC. HOLES ±

CONTRACT NO.

DO NOT SCALE THIS DRAWING

MATERIAL:

DRAWN J. QUARTUCCIO 11/19/83

CHECKED D. Lorch 11/20/83

APPROVED

APPROVED

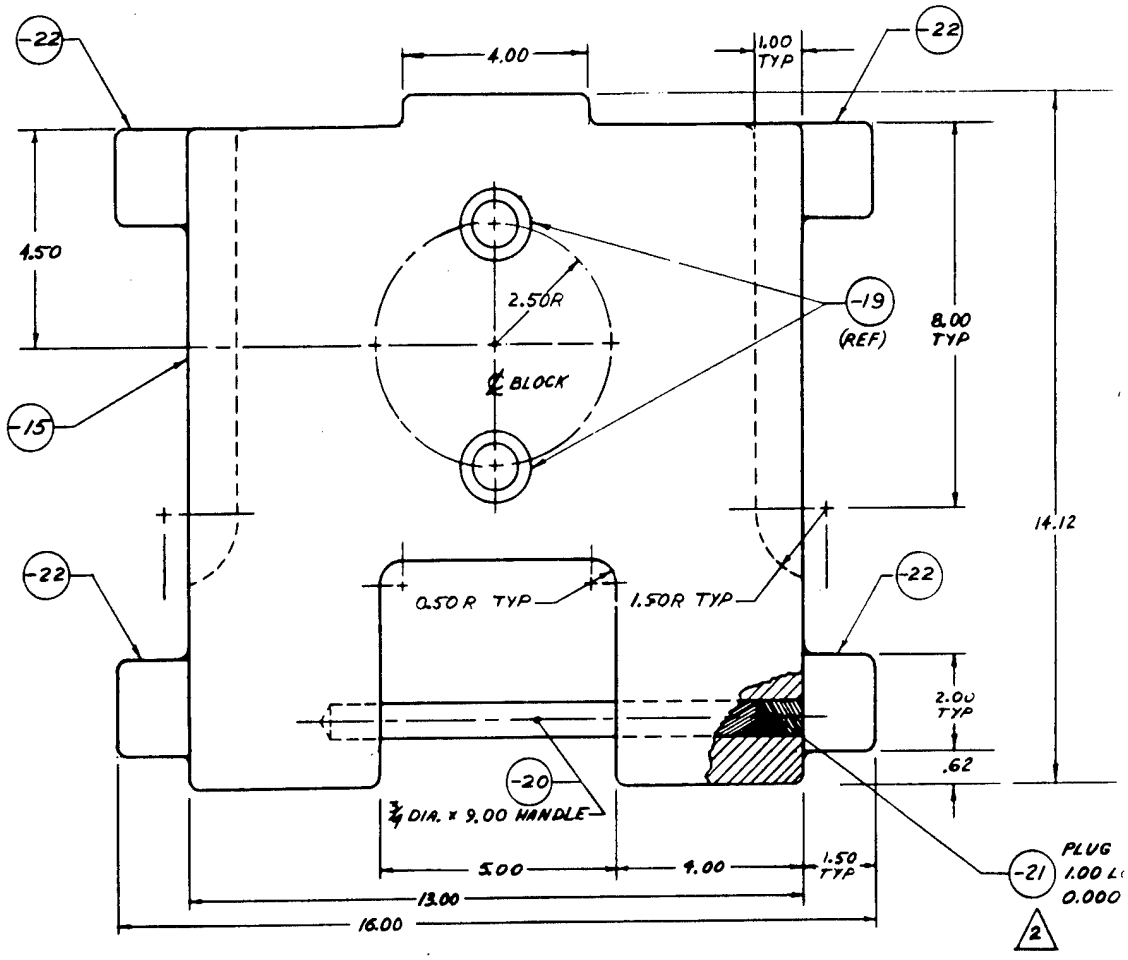
NAVAL AIR DEVELOPMENT CENTER
WARMINSTER, PA. 18974

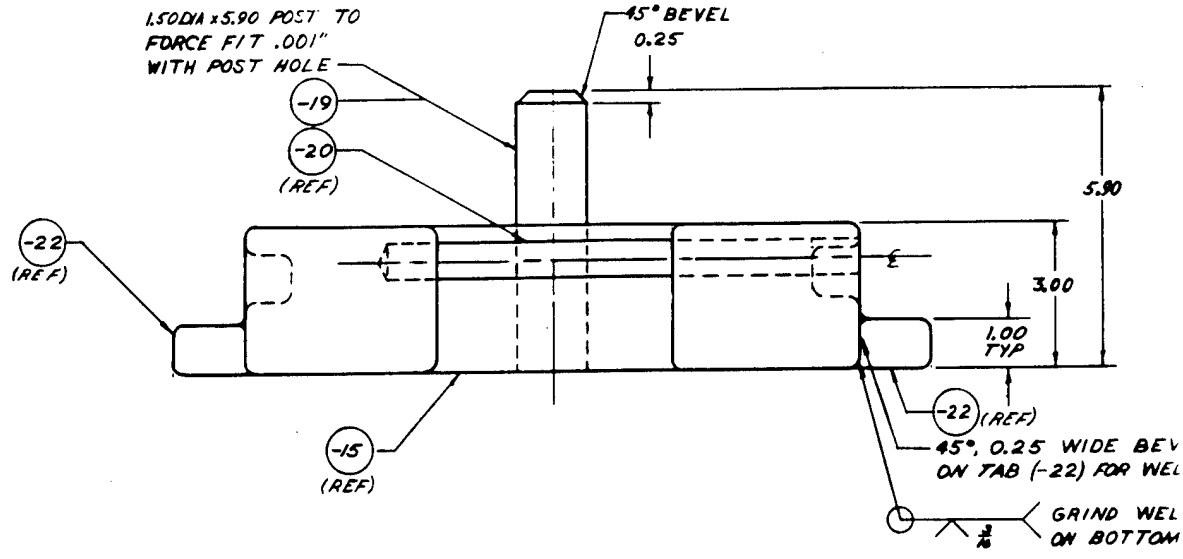
S-3A BALLAST BLOCK ASSEMBLY

SIZE D | CAGE IDENT NO. 80206 | SHOP DWG NO. S3ABB4/1 | REV

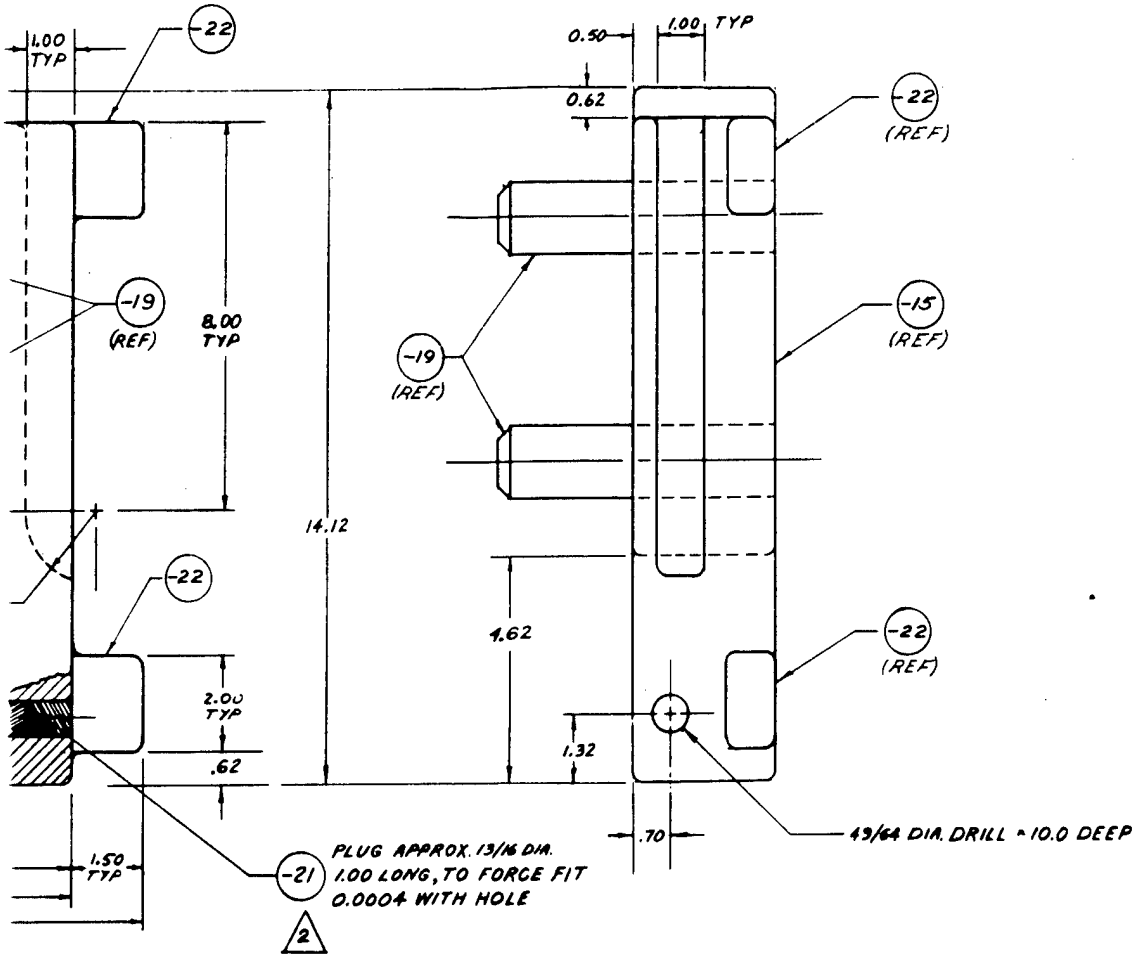
SCALE 1/3 | WT 16T/ASSY. | SHEET 1 OF 8

PLATE NO. 10000


-22
4.00
1.00 TYP
-22
4.50
2.50R
-19 (REF)
8.00 TYP
℄ BLOCK
-15
14.12
-22
0.50R TYP
1.50R TYP
-22
2.00 TYP
.62
-20
¾ DIA. x 9.00 HANDLE
5.00
4.00
1.50 TYP
-21
PLUG
1.00 L
0.000
2
13.00
16.00


1.50DIA x 5.90 POST TO FORCE FIT .001" WITH POST HOLE
45° BEVEL 0.25
-19
-20 (REF)
5.90
-22 (REF)
3.00
1.00 TYP
-22 (REF)
-15 (REF)
45°, 0.25 WIDE BEV
ON TAB (-22) FOR WEL
GRIND WEL
ON BOTTOM

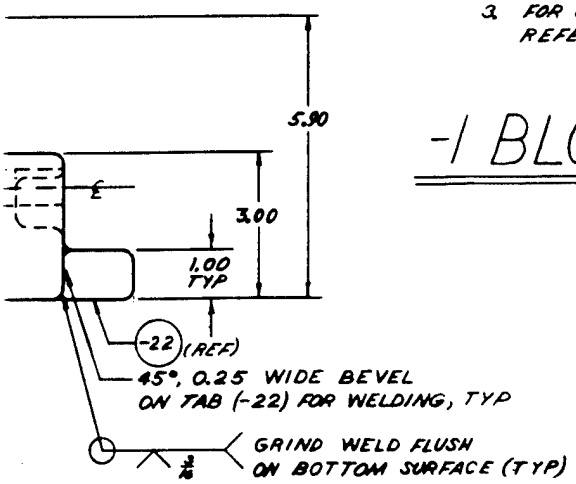
Figu



NOTES: 1. ALL EDGES AND CORNERS HAVE $\frac{1}{4}$R UNLESS OTHERWISE STATED.

2. ASSEMBLE TWO SHOULDER HARNESS STRAP ASSYS. (-8) AROUND HANDLE (-20) BEFORE FORCE FITTING PLUG (-21) INTO HOLE.

3. FOR CHARACTER STAMPING DETAIL, REFER TO SHEET 8.



-1 BLOCK ASSY.

DO NOT SCALE THIS DRAWING	DRAWN: J. QUARTUCCIO
MATERIAL: 6061-T651 ALUMINUM	CHECKED: G. Lund
FINISH: GRAY ANODIZE MIL-A-8625	APPROVED

CONTRACT NO.

Figure 22. Dwg, S-3A Ballast Block, −1 Block

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

0

(-22) (REF)

(-15) (REF)

(-22) (REF)

D

C

A

— 49/64 DIA. DRILL ^10.0 DEEP

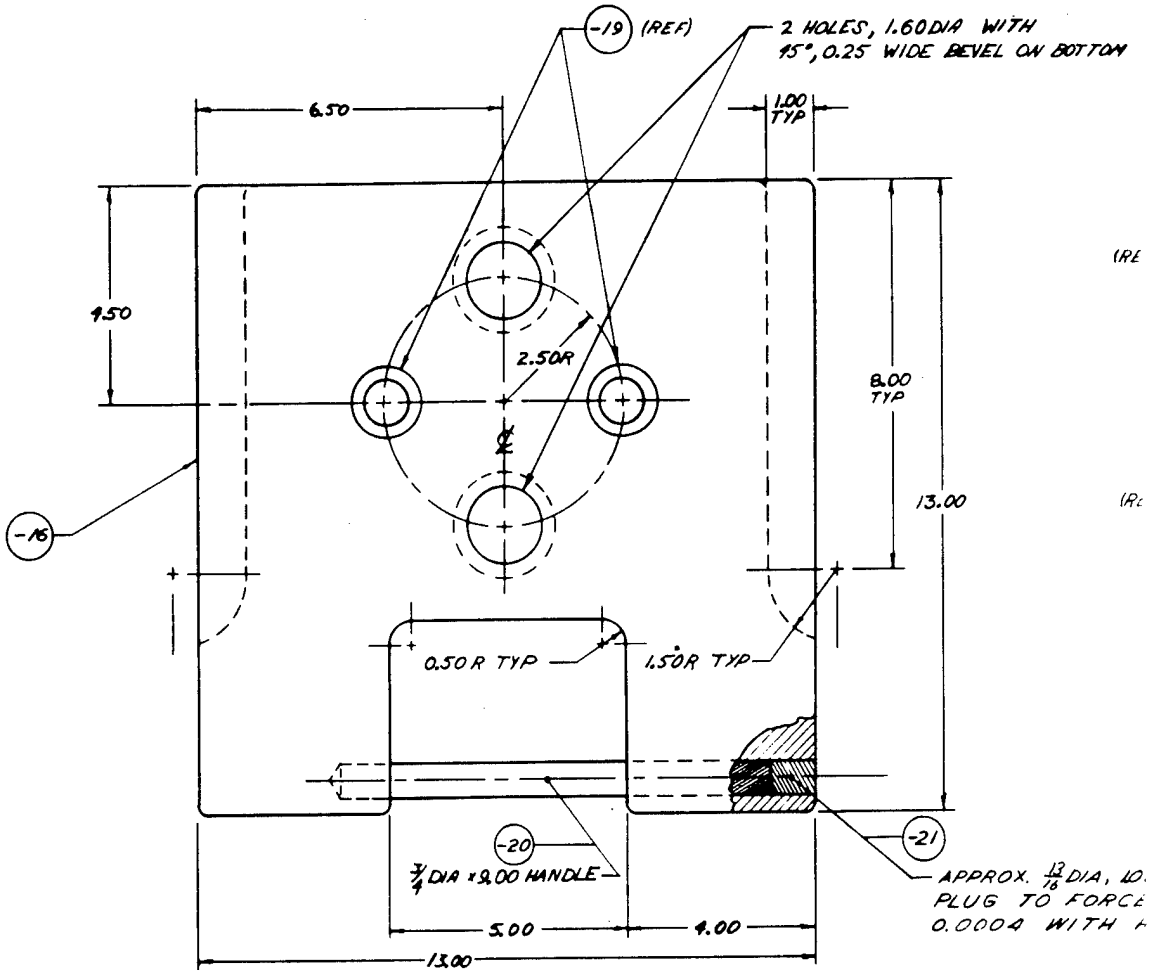
AVE
TED.
ARNESS
D
CE
HOLE.
DETAIL,

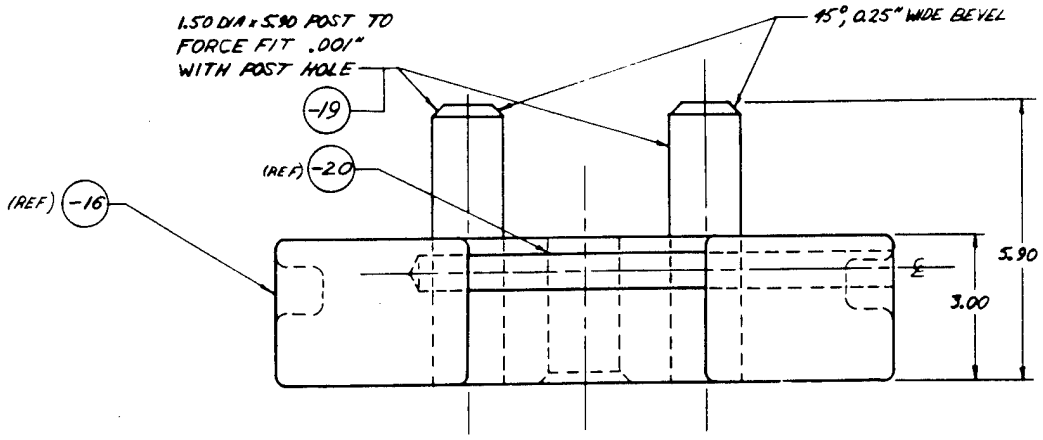
Y.

Block

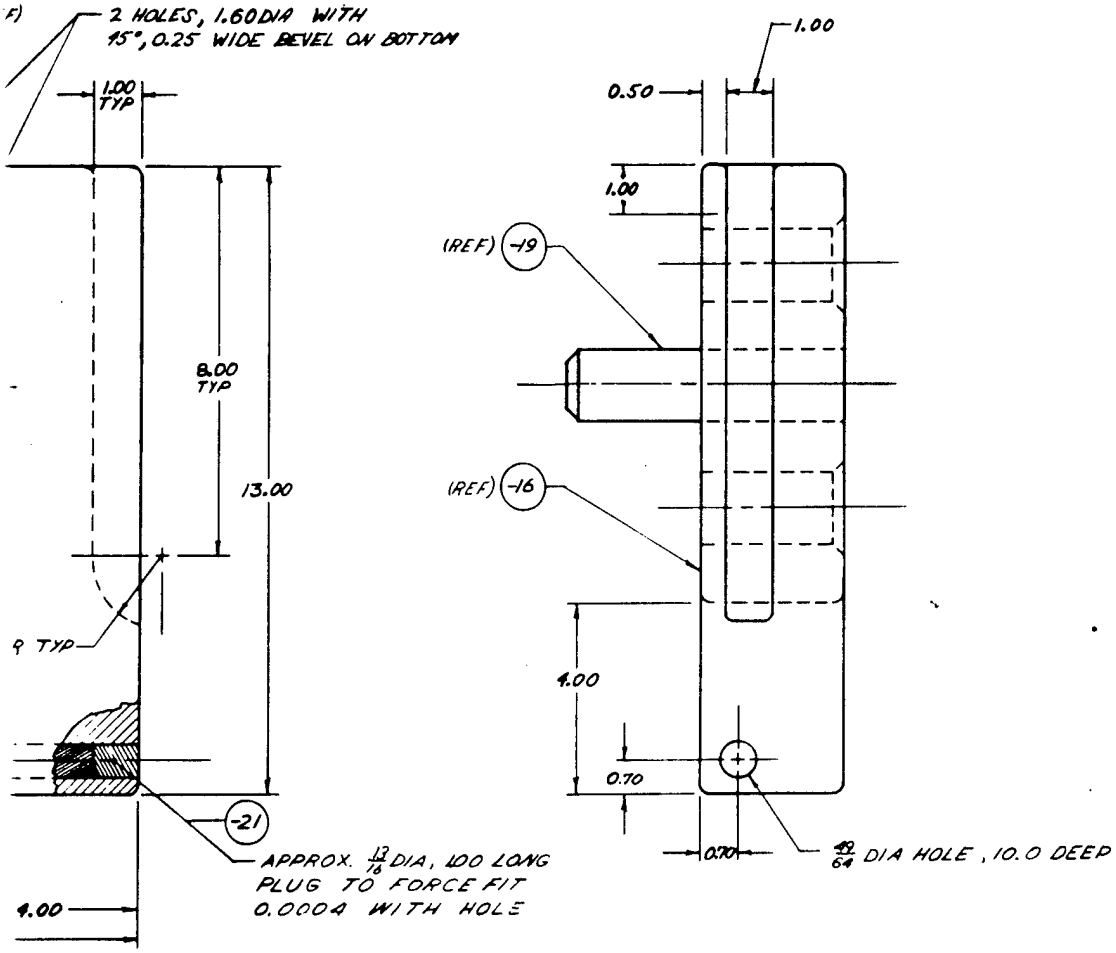
(3)

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± ANGLES ± 2 PLACE DECIMALS ± 3 PLACE DECIMALS ± .01	CONTRACT NO.	NAVAL AIR DEVELOPMENT CENTER WARMINSTER, PA. 18974
DO NOT SCALE THIS DRAWING	DRAWN J. QUARTUCCIO 11/20/85	S-3A BALLAST BLOCK -1 BLOCK
MATERIAL: 6061-T651 ALUMINUM	CHECKED W. Lord 11/20/85	
FINISH: GRAY ANODIZE MIL-A-8625	APPROVED	SIZE D · CAGE IDENT NO. 80206 · BASIC DWG NO. S3ABB4/2 · REV
	APPROVED	SCALE 1/2 · WT · SHEET 2 OF 8


-19 (REF)
2 HOLES, 1.60 DIA WITH
45°, 0.25 WIDE BEVEL ON BOTTOM
6.50
1.00
TYP
4.50
2.50R
8.00
TYP
13.00
-16
0.50R TYP
1.50R TYP
-20
-21
3/4 DIA x 9.00 HANDLE
APPROX. 13/16 DIA, 40.
PLUG TO FORCE
0.0004 WITH
5.00
4.00
13.00


1.50 DIA x 5.90 POST TO
FORCE FIT .001"
WITH POST HOLE
45°, 0.25" WIDE BEVEL
-19
(REF) -20
(REF) -16
5.90
3.00

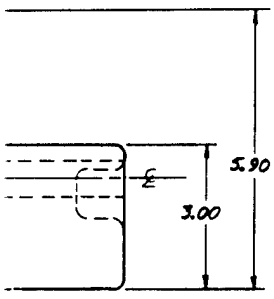
(1)



NOTES: 4. ALL EDGES AND CORNERS HAVE 1/2R UNLESS OTHERWISE STATED.

5. FOR CHARACTER STAMPING DETAIL, REFER TO SHEET 8.

45°, 0.25" WIDE BEVEL



-2 BLOCK ASSY.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± ANGLES ± 3 PLACE DECIMALS ± 2 PLACE DECIMALS ± .01	CONTRACT NO.
DO NOT SCALE THIS DRAWING	DRAWN LQUAR
MATERIAL: 6061-T651 ALUMINUM	CHECKED Q.Lo
FINISH: GRAY ANODIZE MIL-A-8625	APPROVED
	APPROVED

Figure 23. Dwg, S-3A Ballast Block, –2 Block

34015-60

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

D

C

DIA HOLE, 10.0 DEEP

S HAVE
STATED
PING DETAIL,

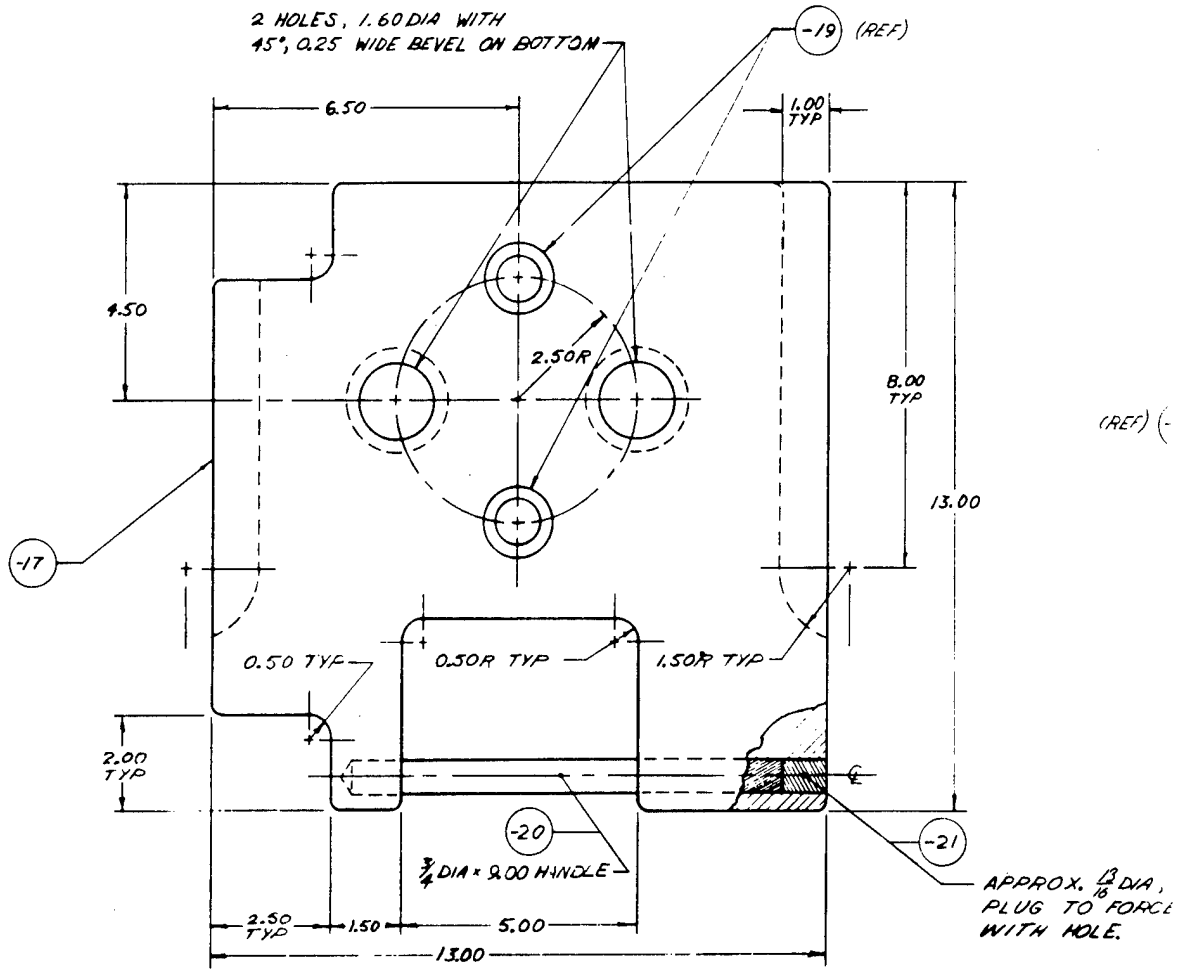
SSY.

A

Block, –2 Block

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± ANGLES ± 2 PLACE DECIMALS ± 3 PLACE DECIMALS ± .01	CONTRACT NO.	NAVAL AIR DEVELOPMENT CENTER WARMINSTER, PA. 18974	
DO NOT SCALE THIS DRAWING	DRAWN J.QUARTUCCIO 11/18/03	S-3A BALLAST BLOCK -2 BLOCK	
MATERIAL: 6061-T651 ALUMINUM	CHECKED Q.Lord 11/20/03		
FINISH: GRAY ANODIZE MIL-A-8625	APPROVED	SIZE D CODE IDENT NO. 80206	NADC DWG NO. S3ABB4/3 REV
	APPROVED	SCALE 1/2 WT	SHEET 3 OF 8

(3)


2 HOLES, 1.60 DIA WITH
45°, 0.25 WIDE BEVEL ON BOTTOM
-19 (REF)
6.50
1.00 TYP
4.50
2.50R
8.00 TYP
13.00
-17
0.50 TYP
0.50R TYP
1.50R TYP
2.00 TYP
-20
-21
3/4 DIA x 9.00 H HOLE
APPROX. 13/16 DIA, PLUG TO FORCE WITH HOLE.
2.50 TYP
1.50
5.00
13.00

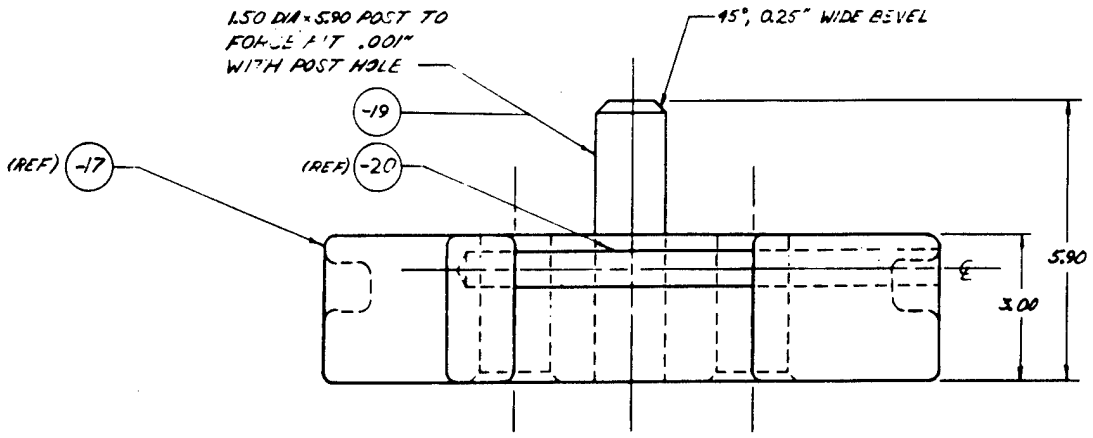
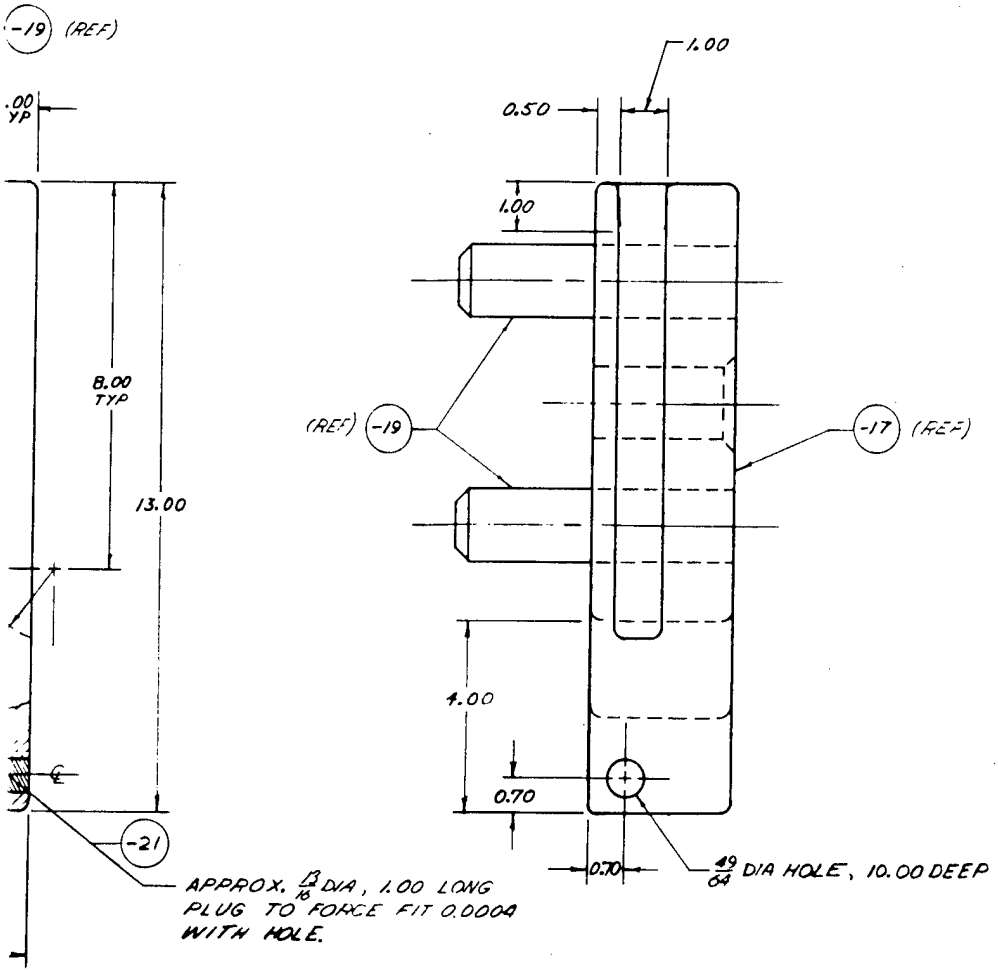

1.50 DIA x 5.90 POST TO FORCE FIT .001" WITH POST HOLE
45°, 0.25" WIDE BEVEL
-19
(REF) -17
(REF) -20
5.90
3.00

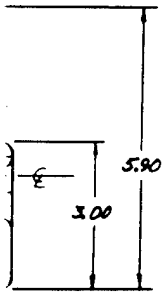
Figure 2

ZONE | LTR



NOTES: 6. ALL EDGES AND CORNERS HAVE 1/4 R UNLESS OTHERWISE STATED.

7. FOR CHARACTER STAMPING DETAIL, REFER TO SHEET 8.



-3 BLOCK ASSY.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± ANGLES ± 3 PLACE DECIMALS ± 2 PLACE DECIMALS ± .01	CONTRACT NO.
DO NOT SCALE THIS DRAWING	DRAWN J.QUARTUCCIO
MATERIAL: 6061-T651 ALUMINUM	CHECKED D. Ford 11/20/85
FINISH: GRAY ANODIZE MIL-A-8625	APPROVED
	APPROVED

Figure 24. Dwg, S-3A Ballast Block, –3 Block

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

D

(-17) (REF)

C

, 10.00 DEEP

ETAIL,

A

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES.
TOLERANCES ARE:
FRACTIONS ± ANGLES ±
3 PLACE DECIMALS ±
2 PLACE DECIMALS ± .01

DO NOT SCALE THIS DRAWING

MATERIAL:
6061-T651 ALUMINUM

FINISH:
GRAY ANODIZE
MIL-A-8625

CONTRACT NO.

DRAWN	J.QUARTUCCIO	
CHECKED	[illegible]	11/20/8
APPROVED		
APPROVED		

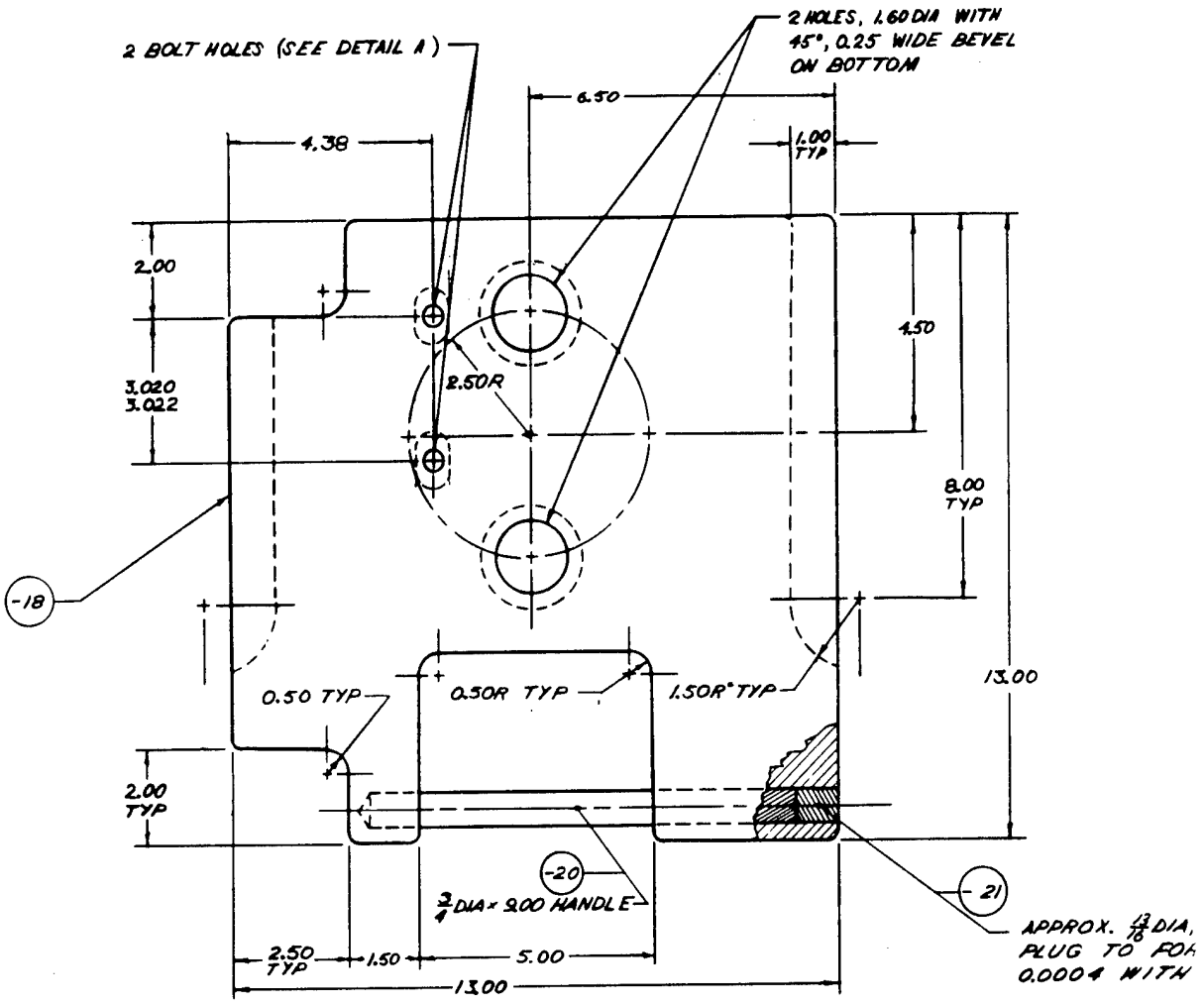
NAVAL AIR DEVELOPMENT CENTER
WARMINSTER, PA. 18974

S-3A BALLAST BLOCK
-3 BLOCK

SIZE	CODE IDENT NO.	NADC DWG NO.	REV
D	80206	S3ABB 4/4	

SCALE 1/2 | WT | SHEET 4 OF 8

(3)


2 BOLT HOLES (SEE DETAIL A)
2 HOLES, 1.60 DIA WITH 45°, 0.25 WIDE BEVEL ON BOTTOM
6.50
4.38
1.00 TYP
2.00
3.020
3.022
2.50R
4.50
8.00 TYP
-18
0.50 TYP
0.50R TYP
1.50R TYP
13.00
2.00 TYP
-20
3/4 DIA x 2.00 HANDLE
-21
APPROX. 13/16 DIA, PLUG TO FOR
0.0004 WITH
2.50 TYP
1.50
5.00
13.00

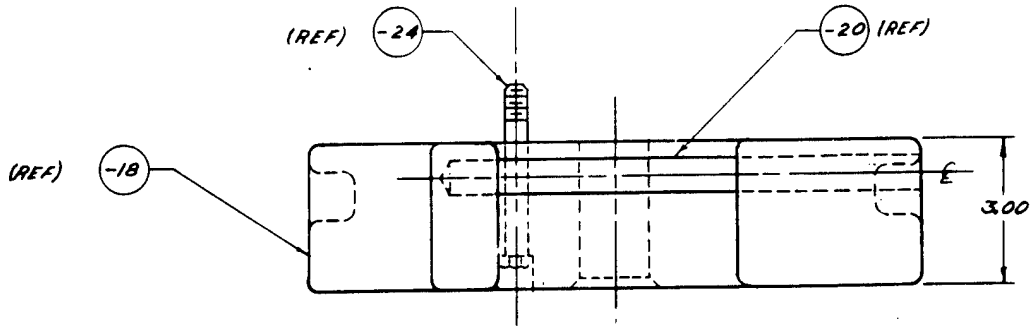
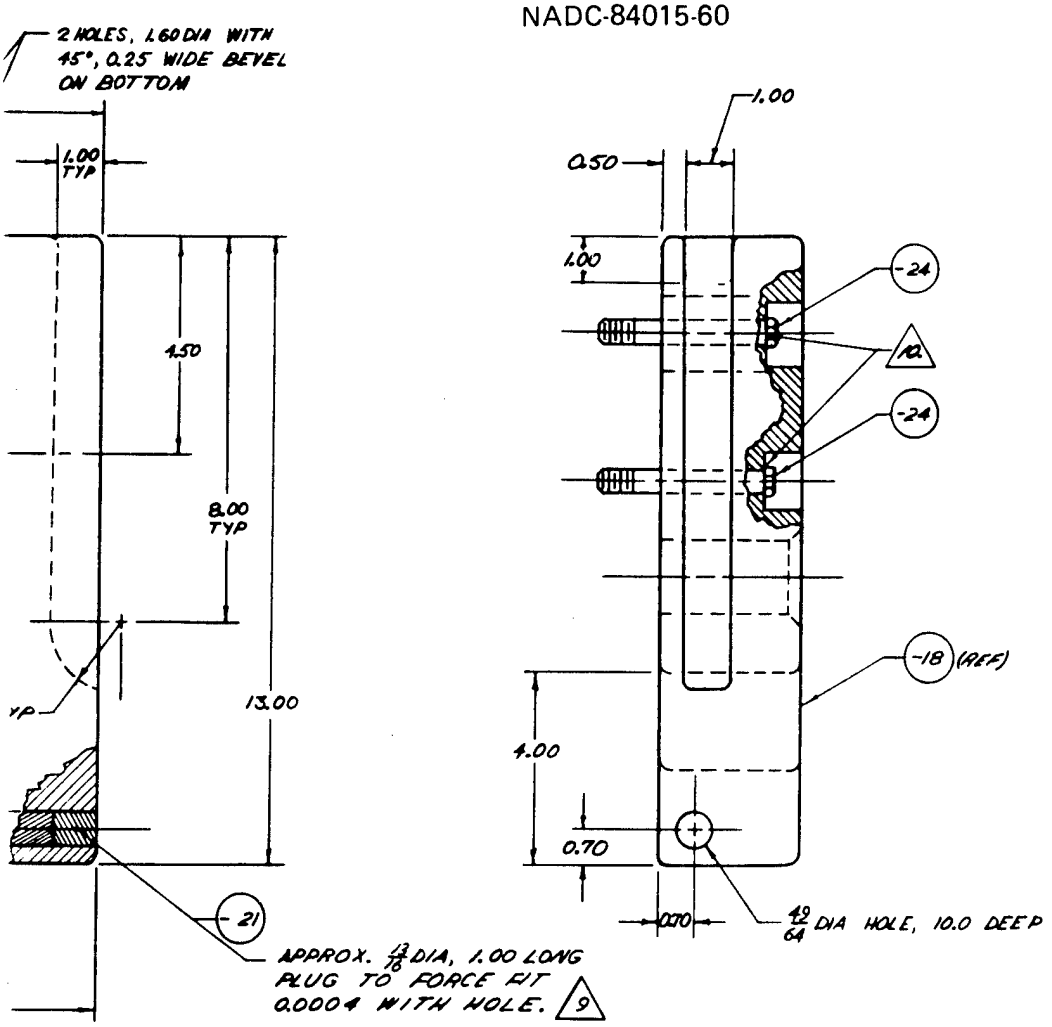
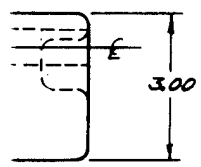

(REF)
-24
-20 (REF)
(REF)
-18
3.00

Figure 2





NOTES: 8. ALL EDGES AND CORNERS HAVE 1/4 R UNLESS OTHERWISE STATED.

9. ASSEMBLE LAPBELT ASSY. (-7) AROUND HANDLE (-20) BEFORE FORCE FITTING PLUG (-21) INTO HOLE.

10. APPLY 1/2 IN. OF "LOCTITE" CEMENT BELOW BOLT HEAD BEFORE INSERTING BOLT.

11. FOR CHARACTER STAMPING DETAIL, REFER TO SHEET 8.

-4 BLOCK ASSY.

ZONE L

0.75

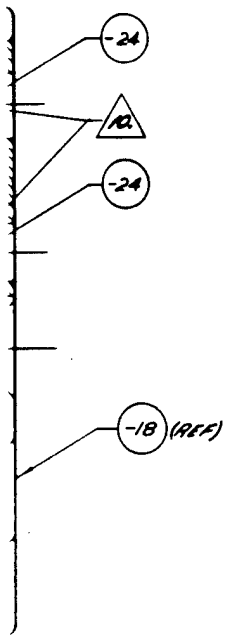
COUNTERSINK DETAILS

DETAIL A: E

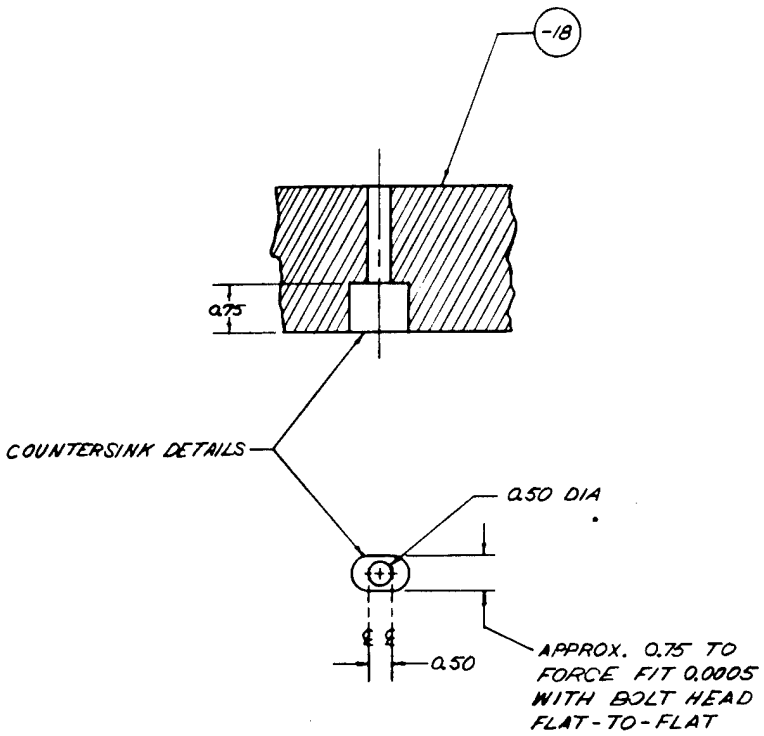
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± ANGLES ± 2 PLACE DECIMALS ± .00 3 PLACE DECIMALS ± .01	CONTRACT NO.
DO NOT SCALE THIS DRAWING	DRAWN J. QUARTUCCI
MATERIAL: 6061-T651 ALUMINUM	CHECKED D. Ford
FINISH: GRAY ANODIZE MIL-A-8625	APPROVED
	APPROVED

Figure 25. Dwg, S-3A Ballast Block, –4 Block

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



$\frac{49}{4}$ DIA HOLE, 10.0 DEEP



DETAIL A: BOLT HOLE

CORNERS'
S OTHERWISE

:T ASSY. (-7)
-20) BEFORE
PLUG (-21)

:OCTITE" CEMENT BELOW
RE INSERTING BOLT.
STAMPING DETAIL, REFER

ASSY.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± ANGLES ± 3 PLACE DECIMALS ± .005 2 PLACE DECIMALS ± .01	CONTRACT NO.	NAVAL AIR DEVELOPMENT CENTER WARMINSTER, PA. 18974	
DO NOT SCALE THIS DRAWING	DRAWN J. QUARTUCCIO	S-3A BALLAST BLOCK -4 BLOCK	
MATERIAL: 6061-T651 ALUMINUM	CHECKED G. Lord 11/26/69		
FINISH: GRAY ANODIZE MIL-A-8625	APPROVED	SIZE D CODE IDENT NO. 80206	DWG NO. S3ABB4/5 REV
	APPROVED	SCALE 1/2 WT	SHEET 5 OF 8

-4 Block

(3)

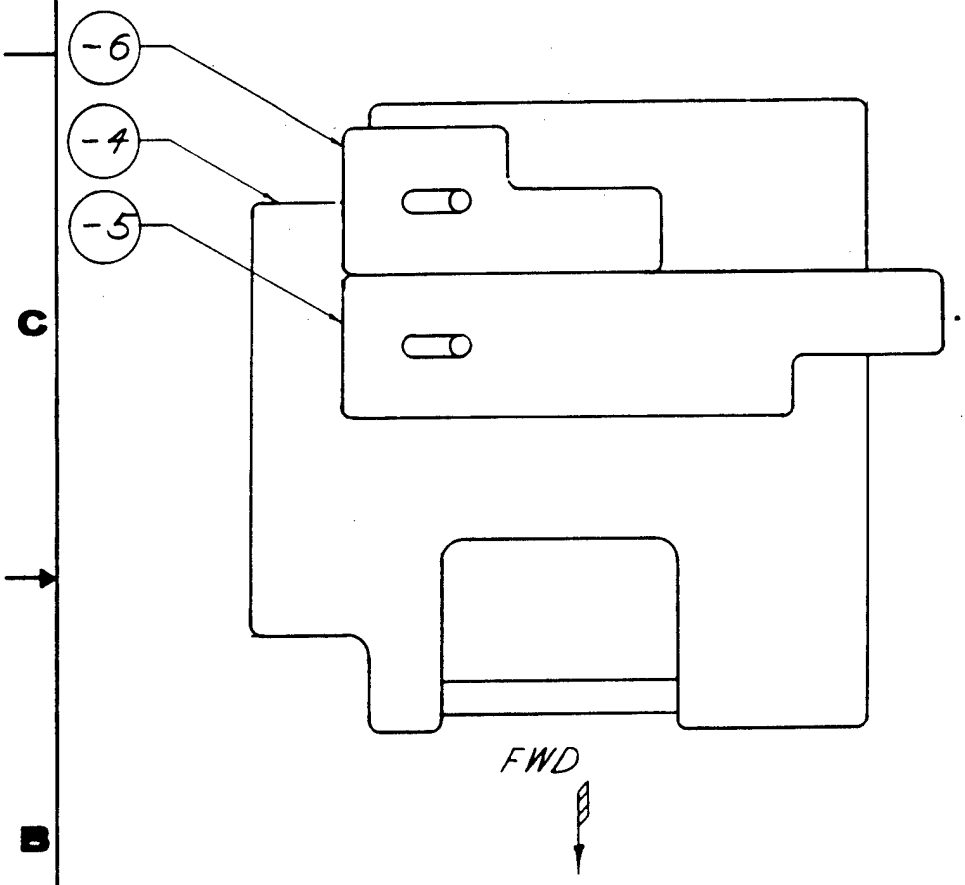


PLATE ORIENTATION IN SEAT

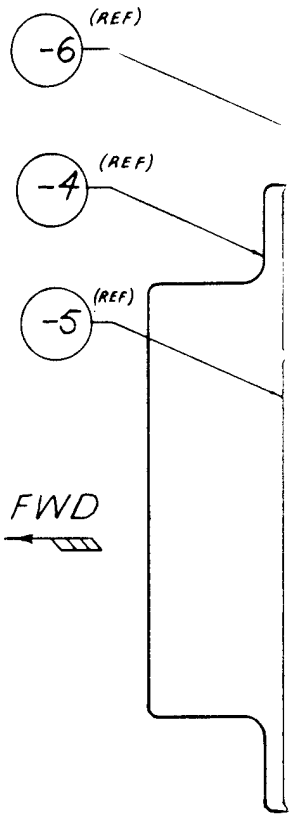


PLATE O

Figure 26. Dw

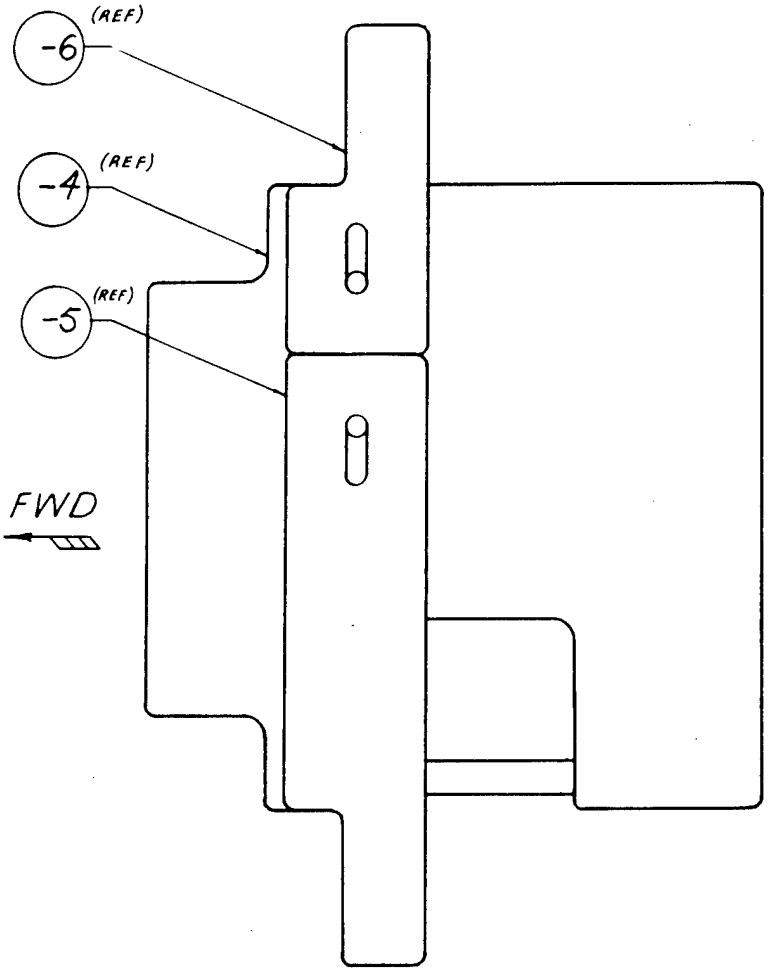
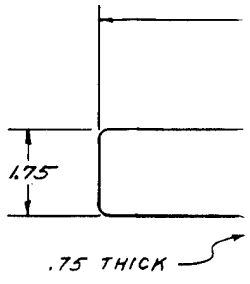


PLATE ORIENTATION IN AISLEWAY

Figure 26. Dwg, S-3A Ballast Block, Aisle Locking Plate



NOTES: 12. ALL OUTER C
EDGES HAVE
13. SLOT EDGES
14. FOR CHARACTE
REFER TO SHE

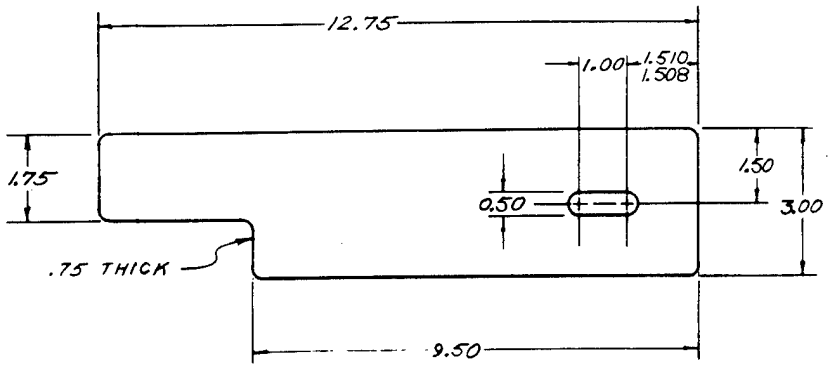
-5 LOCKI

NOTES: 15. ALL OUTER
EDGES HAVE
16. SLOT EDGES
17. FOR CHARAC
REFER TO SH

-6 LOCKIN

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES.
TOLERANCES ARE:
FRACTIONS ±
ANGLES ±
2 PLACE DECIMALS ± .01
3 PLACE DECIMALS ± .001
DO NOT SCALE THIS DRAWING
MATERIAL:
6061-T651 ALUMINUM
FINISH:
GRAY ANODIZE
MIL-A-8625
CONTRACT NO.
DRAWN
CHECKED
APPROVED
DATE

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

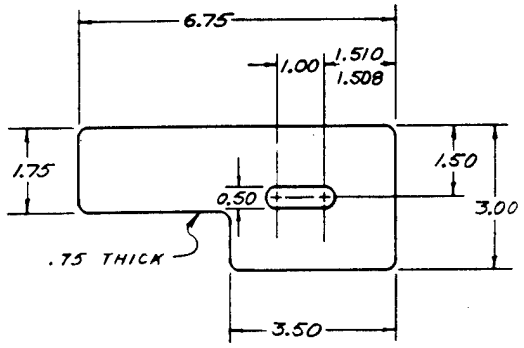


NOTES: 12. ALL OUTER CORNERS AND EDGES HAVE 1/4 R

13. SLOT EDGES HAVE 1/16 R

14. FOR CHARACTER STAMPING DETAIL, REFER TO SHEET 8.

-5 LOCKING PLATE DETAIL



NOTES: 15. ALL OUTER CORNERS AND EDGES HAVE 1/4 R

16. SLOT EDGES HAVE 1/16 R

17. FOR CHARACTER STAMPING DETAIL, REFER TO SHEET 8.

-6 LOCKING PLATE DETAIL

AISLEWAY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE TO FINISHED. TOLERANCES ARE: FRACTIONS ± ANGLES ± 2 PLACE DECIMALS ± .01 3 PLACE DECIMALS ± .001	CONTRACT NO.	NAVAL AIR DEVELOPMENT CENTER WARMINSTER, PA. 18974
DO NOT SCALE THIS DRAWING	DRAWN J. QUARTUCCIO	S-3A BALLAST BLOCK AISLE LOCKING PLATES
MATERIAL: 6061-T651 ALUMINUM	CHECKED 11/28/95	
FINISH: GRAY ANODIZE MIL-A-8625	APPROVED	SIZE D · CODE IDENT NO. 80206 · SHEET 6 OF 8

Locking Plate

(3)

NOTES:

19. MATERIALS (REPEATED FROM SHEET 1):

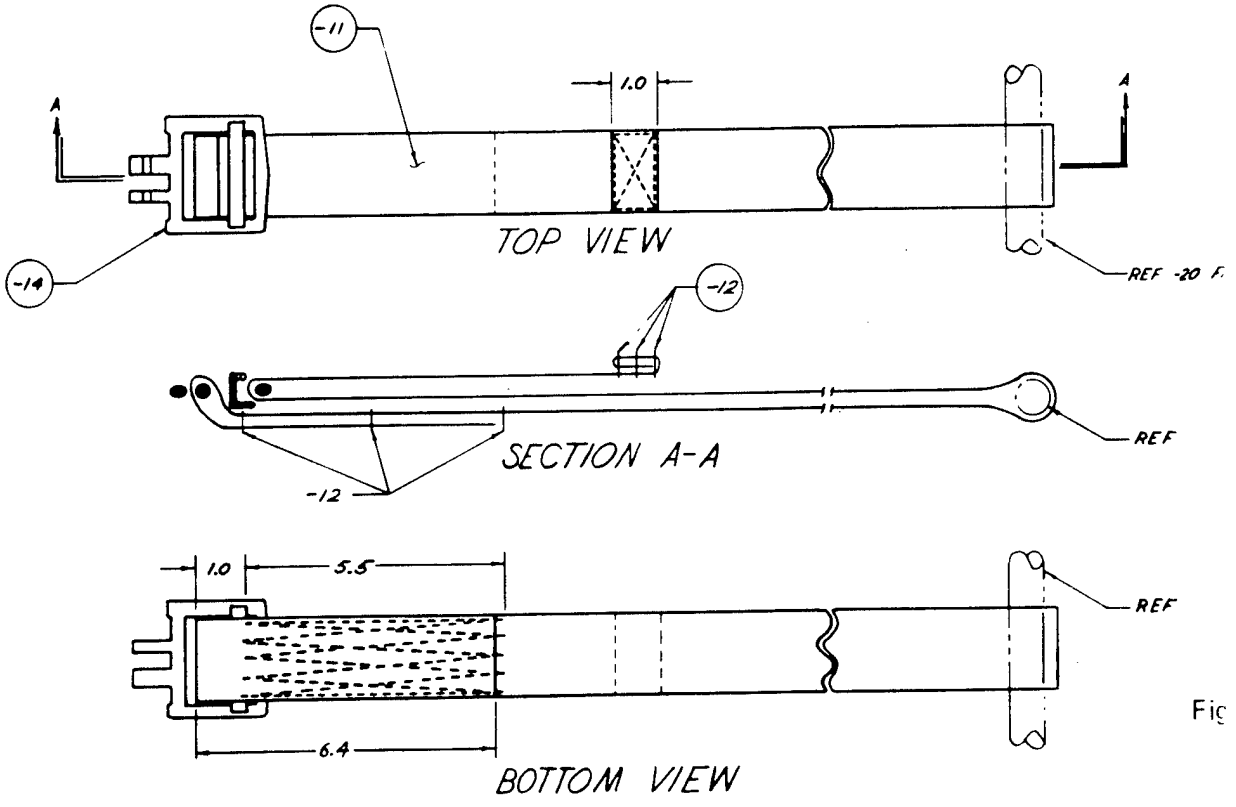
PART NO.	NO. REQD. PER ASSY.	DESCRIPTION	SIZE	MATERIAL	SPECIFICATION
-9	1	LAP BELT STRAP – ONE CONTINUOUS STRAP, LOOPED BACK ON ITSELF	$1\frac{3}{4}$ x 44	NYLON, SAGE GRN. WEBBING	MIL-W-4088 TY XII.
-10	1	CROSS STRAP	$1\frac{3}{4}$ x 11	" "	" "
-11	2	SHOULDER HARNESS STRAP	$1\frac{3}{4}$ x 54	" "	" "
-12	AS REQUIRED	THREAD		NYLON SAGE GRN., 6 CORD	V-T-295 NIIN 00-559-5211
-13	2	LAP BELT QUICK RELEASE FITTING			P/N 015-11366-1 (HOCH)
-14	2	SHOULDER HARNESS QUICK RELEASE FITTING			P/N 015-710001-1 (HOCH)

20. SEAR ENDS OF NYLON WEBBING TO PREVENT FRAYING, AVOID FORMING SHARP EDGES.

21. ALL STITCHING SHALL BE 4 TO 6 THREADS PER INCH.

22. STITCHING ALONG EDGE SHALL BE $\frac{1}{8}$ IN. AWAY FROM EDGE OF WEBBING.

23. ALL STITCHING SHALL BE BACKSTITCH $\frac{1}{2}$ MIN.



Fig

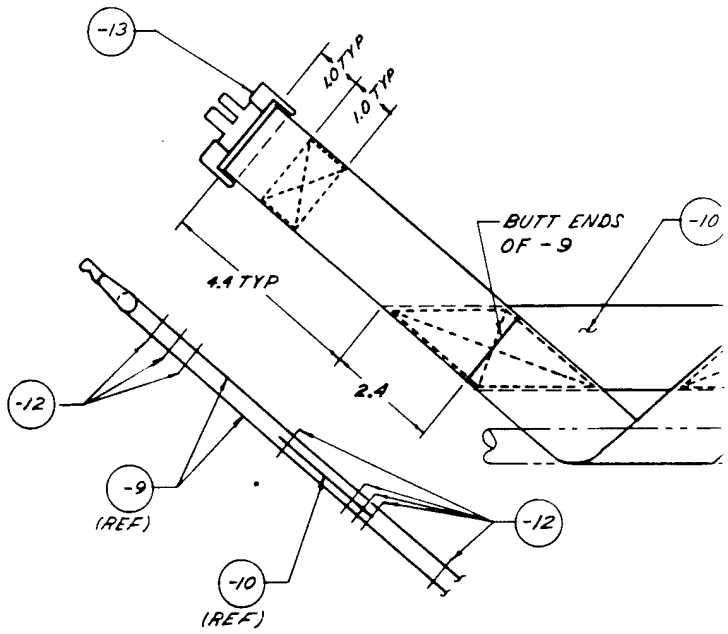
-8 SHOULDER HARNESS STRAP ASSY. (2 REQ

(1)

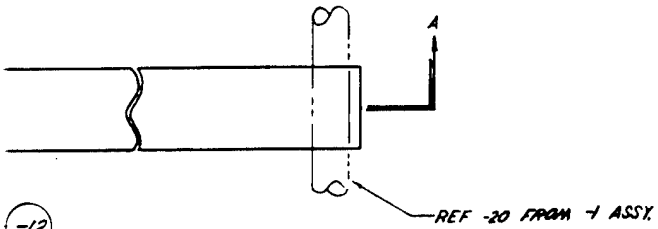
SIZE	MATERIAL	SPECIFICATION
$1\frac{3}{4}$ x 44	NYLON, SAGE GRN. WEBBING	MIL-W-4088 TY XIII
$\frac{3}{4}$ x 11	" "	" "
$\frac{3}{4}$ x 54	" "	" "
	NYLON SAGE GRN., 6 CORD	V-T-295 NIIN 00-559-5211
		P/N 015-11366-1 (NOCM)
		P/N 015-710001-1 (NOCM)

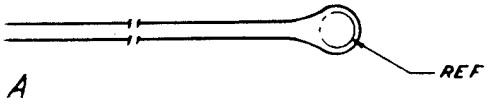
) FORMING SHARP EDGES.

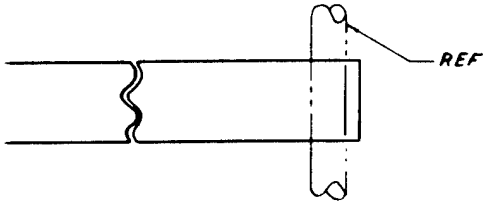
OF WEBBING.

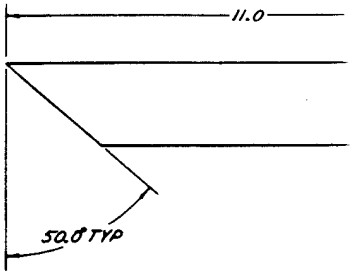


-7 LAP BEL









-10 CROSS

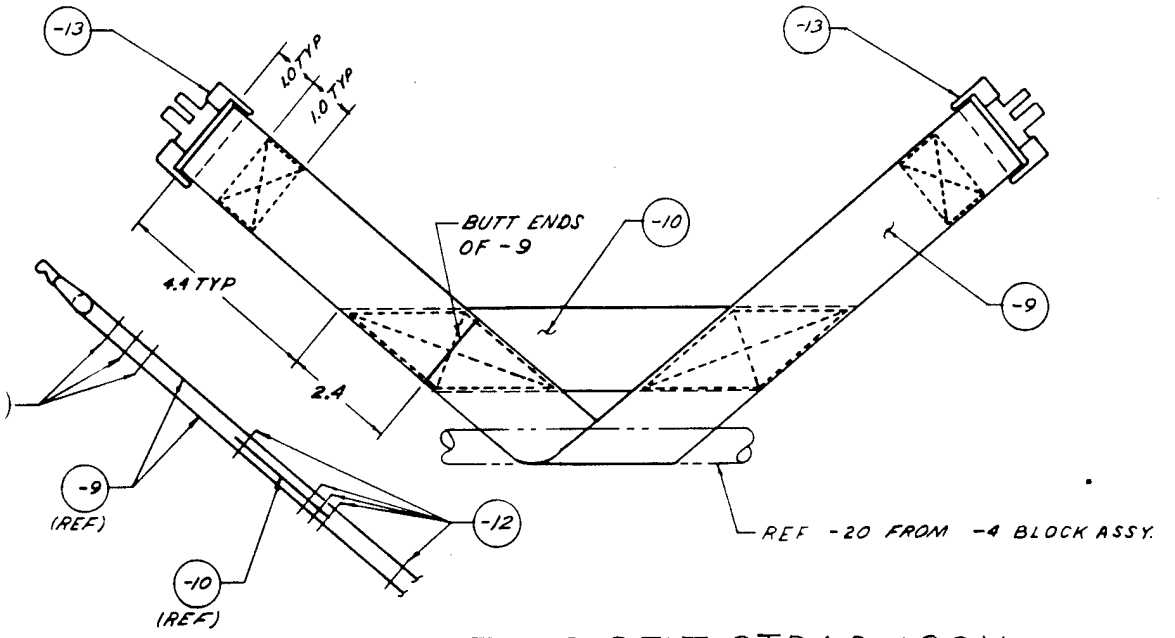
SS STRAP ASSY. (2 REQD) (2)

DO NOT SCALE THIS DRAWING	
MATERIAL: SEE NOTE 19.	

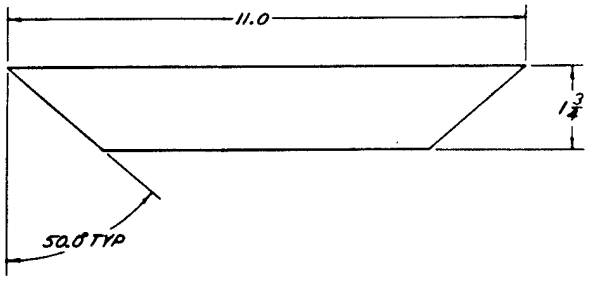
Figure 27. Dwg, S-3A Ballast Block, Strap Assemblies

4015-60

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



-7 LAP BELT STRAP ASSY. (1 REQD)

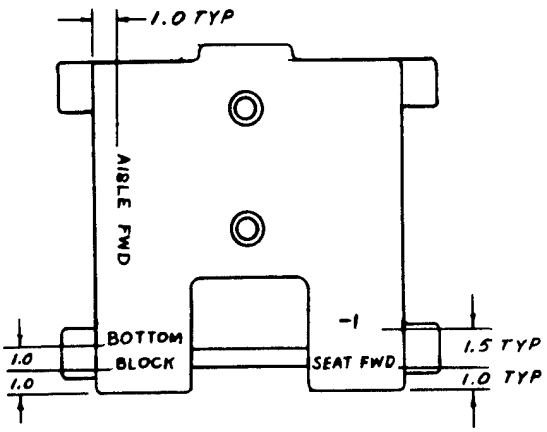


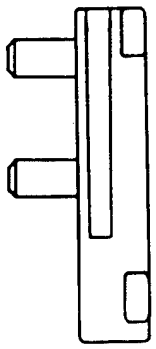
-10 CROSS STRAP

ock, Strap Assemblies

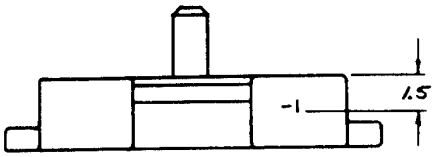
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE TO FINISH. TOLERANCES ARE: FRACTIONS ± ANGLES ± 2 PLACE DECIMALS ± 3 PLACE DECIMALS ±	CONTRACT NO.	NAVAL AIR DEVELOPMENT CENTER WARMINSTER, PA. 18974
DO NOT SCALE THIS DRAWING	DRAWN LQUARTUCCIO	S-3A BALLAST BLOCK STRAP ASSEMBLIES
MATERIAL: SEE NOTE 19.	CHECKED D. Ford 4/16/93	
	APPROVED	SIZE D · CAGE IDENT NO. 80206 · TRADE CODE NO. S3ABB4/7 · REV
	APPROVED	SCALE 1/2 · WT · SHEET 7 OF 8

(3)

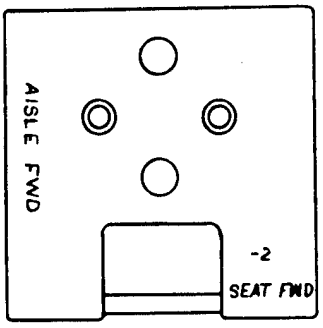


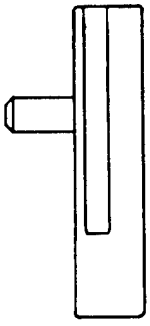


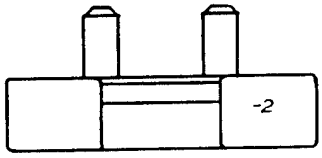
NOTE: 2. CENTER ALL LABELS UNLESS OTHERWISE STATED.



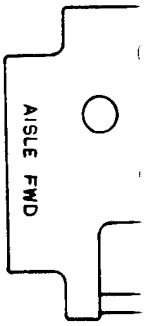
-1 BLOCK ASSY.

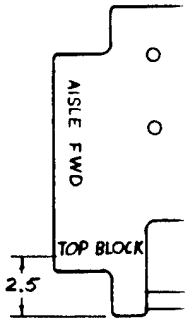






-2 BLOCK ASSY.





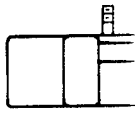
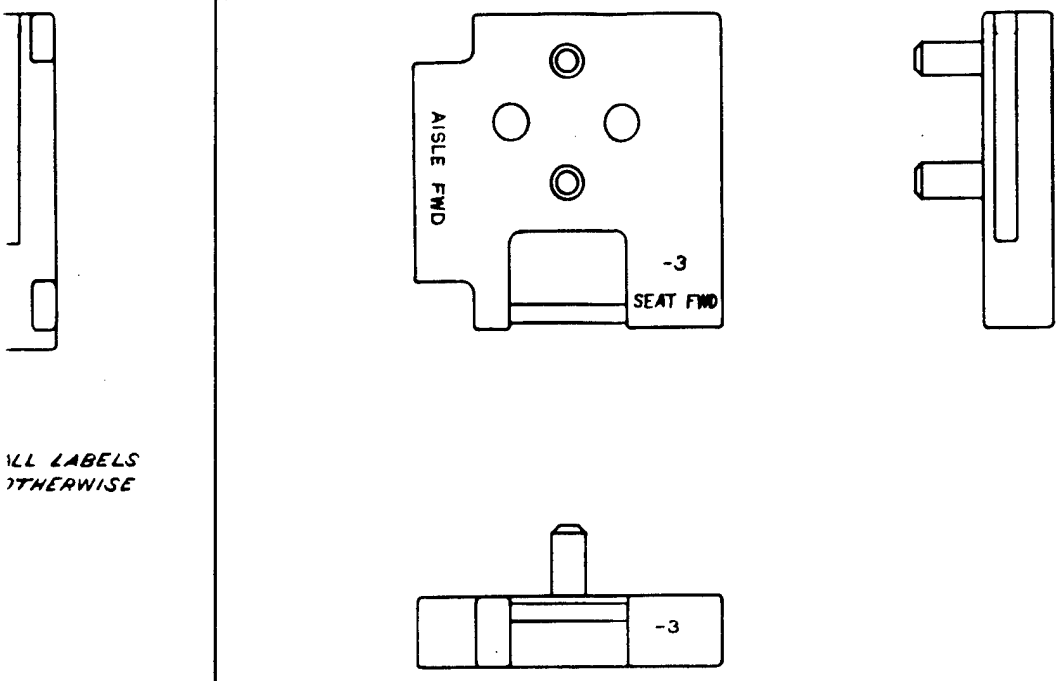


Figure 28



-3 BLOCK ASSY.

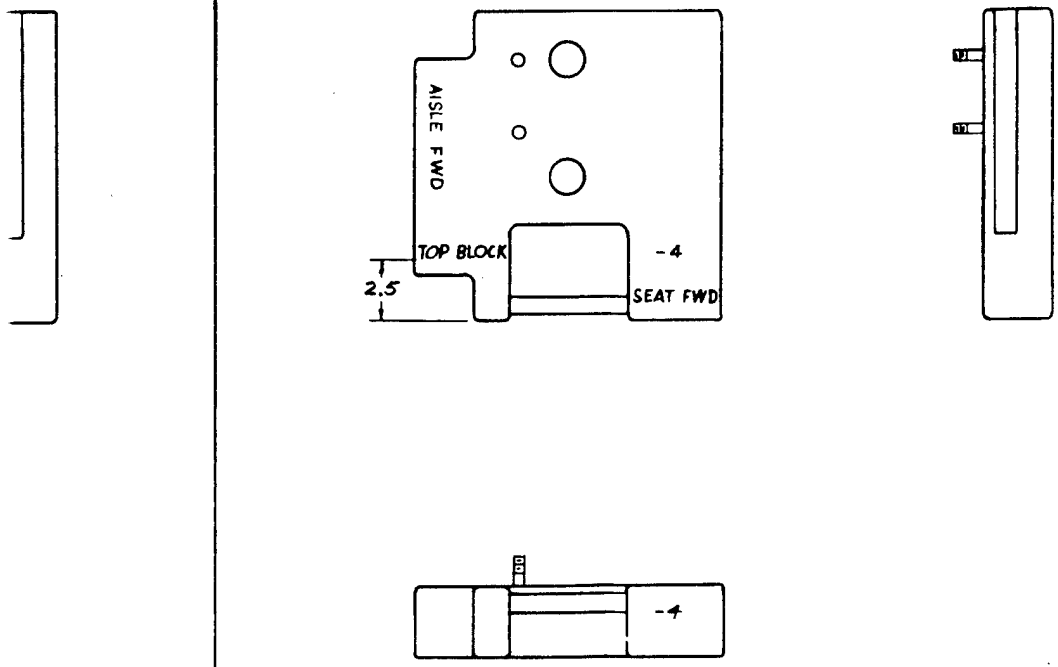


Figure 28. Dwg, S-3A Ballast Block, Stamping Detail

-4 BLOCK ASSY.

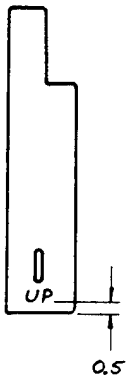
NOTES: 25. ALL STAMP
26. SEE -1 BLOC
27. STAMPING

DO NOT SCALE THIS DRAWING

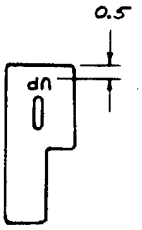
MATERIAL:

N/A

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



-5 LOCKING PLATE



-6 LOCKING PLATE

NOTES: 25. ALL STAMPING IS 3/8 IN. HIGH
26. SEE -1 BLOCK FOR TYPICAL STAMPING LOCATION
27. STAMPING IS NOT DRAWN TO SCALE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ±, ANGLES ±, 2 PLACE DECIMALS ±, 3 PLACE DECIMALS ±

DO NOT SCALE THIS DRAWING

MATERIAL: N/A

CONTRACT NO.

DRAWN J. QUARTUCCIO

CHECKED D. Nowak 11/30/89

APPROVED

APPROVED

NAVAL AIR DEVELOPMENT CENTER
WARMINSTER, PA. 18974

S-3A BALLAST BLOCK STAMPING DETAIL

SIZE	CODE IDENT NO.	DWG NO.	REV
D	80206	S3ABB4/8	

SCALE 1/4 WT SHEET 8 OF 8

PLATE NO. 10000

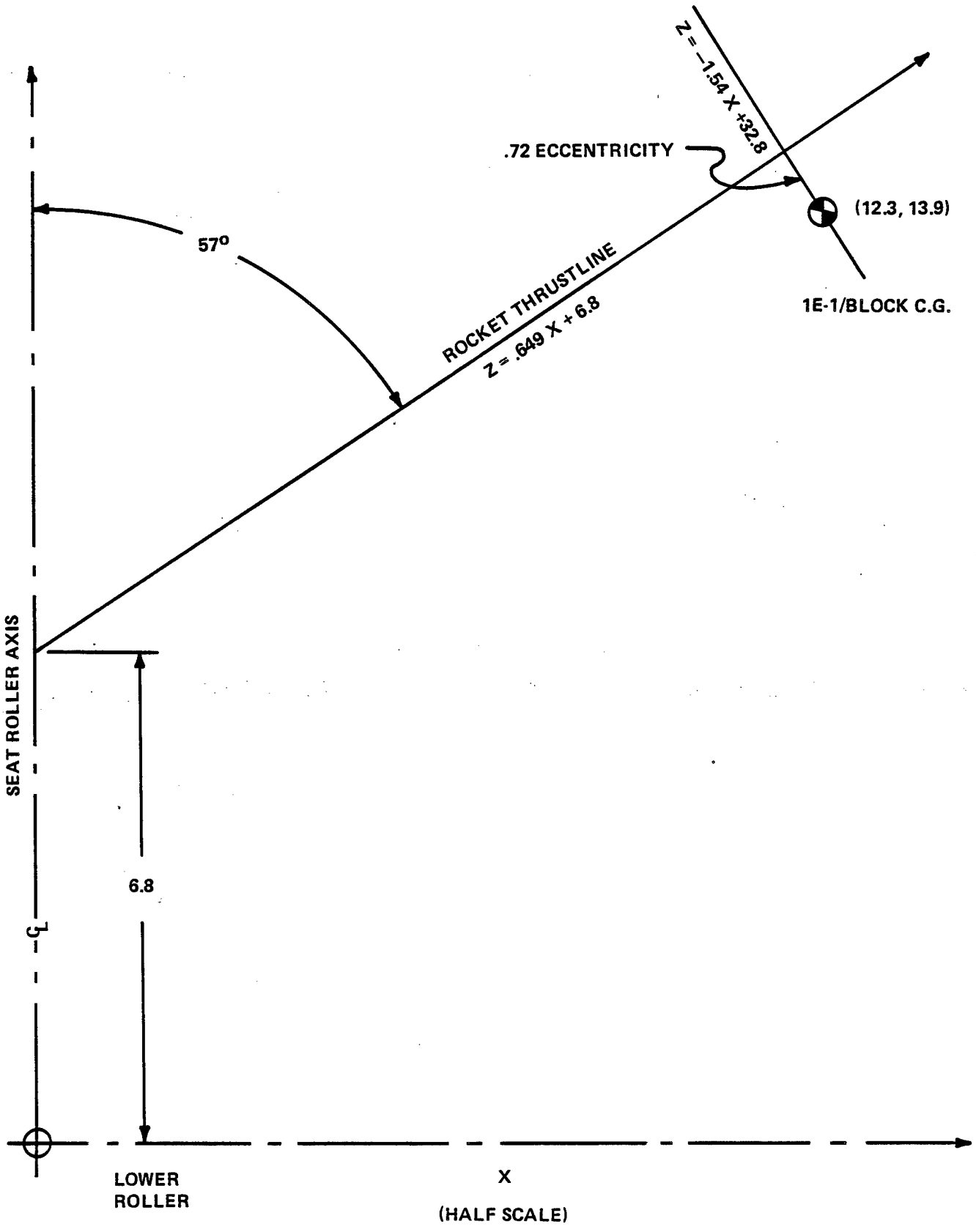


Figure 29. 1E-1 Ballast Block C.G. Eccentricity with Rocket Thrustline